The Internationalization of Creativity as a Learning Competence

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Abstract

This study uses a quantitative content analysis of learning competences – as described and prescribed in 21st century frameworks – and those competences evaluated by international assessments to explore the nexus between recommendation and reality. In drawing insights from the theoretical underpinnings of human capital theory we argue, with respect to creativity, that (i) there is a degree of alignment in the prescription and assessment of creativity as a learning competence and (ii) there is a divergence in the way the competence is discussed, which may account for the lack of acknowledgement as a key skill in preparing students for employment in the knowledge-based economy. These findings suggest a discrepancy between recommendation and reality in that the international frameworks consistently place creativity in the top five highest priority learning competences being prescribed while one of the two international assessments examined places it in the top five highest priority learning competences being assessed. Based on the discourse examined in the documents, we assert that schools need to adjust how and when creativity is discussed, ensuring it is included in every subject. This will ensure students link creativity and innovation in every subject area and, subsequently, every industry in the knowledge-based economy. By making this shift, schools will help students ensure long-term employability as the knowledge-based economy transforms into the intelligent economy.

Keywords

Intelligent economy, 21st century frameworks, international assessments, creativity, learning competences

Introduction

The intersection of education and the economy has emerged as a prominent discourse in the 21st century. In the late 20th century the knowledge-based economy, driven by the need for highly-skilled workers, emerged as knowledge and information replaced manufacturing and physical labor as the primary source of productivity and economic growth (Dale, 2005; Friedman & Mandelbaum, 2011; Organisation for Economic Co-operation and Development [OECD], 1996; Robertson, 2005; Wodak & Fairclough, 2010). This shift placed knowledge as the primary driver of economic

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activity (Cussó & D'Amico, 2005; Dale, 2005; OECD, 1996). In education, the rise of the knowledge-based economy has led to increased enrollment in higher education institutions and to the increase of continuing education and professional development for those already employed. Since education is the principal source of knowledge transfer, the systems of education and the economy are linked through the power of knowledge in the 21st century (OECD, 1996). Within this context, 21st century skills and competences (broadly referring to communication, collaboration, critical thinking, and creativity or the 4C's) were viewed as combining the necessary skills needed in the knowledge society that were not dependent upon the use of information and communication technologies (ICTs) as necessary conditions (OECD, 2008). The existant literature refers to both 21st century competences and 21st century skills. As such, we have chosen to use the term competence "because of its increasing adoption in both political and academic fields" (Voogt & Roblin, 2012, p. 302). While communication, collaboration, and critical thinking have dictated academic and policy research areas, the role that creativity plays in honing the skills needed in the knowledge-based economy has been overlooked. In fact, creative problem-solving abilities are recognized as a required skill, but the concept of creativity is still disciplinary specific and therefore not generalizable (Baer, 2015; Im, Hokanson, & Johnson, 2015). In studying creativity in education, Sawyer (2006) made a distinction between "big C" creativity and "small c" creativity. The former speaks to the ability to solve larger problems while the latter articulates how individuals solve everyday challenges. Moreover, the OECD (2009) saw creativity as both a functional and learning skill that is needed in today's intense ICT-matured environment, which has been shaped by flexible production and service delivery systems. In other words, 21st century skills combine the necessary competence needed in the knowledge society where the use of ICT is not an essential condition. While ICT is instrumental in enabling creativity, it is a widely held belief that creativity starts with people. Although recent studies have focused on the relation between 21st century skills and digital skills (van Laar et al., 2017); how students value creativity as a meta-skill (Ahonen & Kinnunen, 2015); the nature, measure, and nurture of creative potential in educational settings (Barbot, Besançon, & Lubart, 2015); the manifestation of creativity in content-based and project-based approaches (Donovan, Green, & Mason, 2014); and the reciprocity of students' creativity and ethical decision making (Niepel, Mustafic, Greiff, & Roberts, 2015); however, none of the current works have examined how creativity – as described and prescribed in 21st century frameworks –is evaluated through international assessments.

The global knowledge-based economy has furthered globalization whereby geographic barriers, which formerly limited economic activities, are diminished or removed through its basis in technology enabling more communication and therefore more knowledge sharing (Friedman & Mandelbaum, 2011; OECD, 1996). Because of this, national economies, governments, and "International Knowledge Banks (IKBs)" (Jones, 2004) – such as the OECD, the World Bank, the International Monetary Fund, and the United Nations Educational, Scientific and Cultural Organization (UNESCO) – and non-state actors – such as environmental groups, human rights activist, and health organizations – are more interconnected and integrated than ever which enables more economic opportunities for both nations and individuals (Rizvi & Lingard, 2010; The Global Economy, 2016). The rate of innovation has increased due to deeper degrees

of interconnectedness, which is also accelerating the pace at which new knowledge and skills are shaped and desirable (Castano, Mendez, & Galindo, 2016; Moloi, Gravett, & Petersen, 2009; OECD, 1996). These disruptions lead to a knowledge transfer challenge for education, given that knowledge is created faster in the knowledge-based economy than it can be codified in curriculum and textbooks. Traditional content delivery methods, such as paper-based textbook and lecture, continuously decrease in efficacy which has led to the development of new formats such as the flipped classroom. Additionally, the pervasiveness of technology has eased the acquisition of facts and information causing schools to no longer be the primary agents for the transfer of this type of knowledge (Friedman & Mandelbaum, 2011; Neumann, 2016; Simard & Karsenti, 2016; Voogt & Roblin, 2012). This then has led to a shift in how schools prepare students for employment in the knowledge-based economy in that schools are focusing on teaching learning competences in addition to static facts and information (Bevins, Carter, Jones, Moye, & Ritz, 2012; Dede, 2010; Moloi et al., 2009). These learning competences are relevant to multiple fields, inclusive of knowledge, skills, and attitudes, and connected to the competent handling of complexity and unpredictability, both characteristic of 21st century workplace activities (Voogt & Roblin, 2012). With the ubiquity of information and the increased competition brought forth by globalization, the drive for innovation and creation has reached a fevered pitch in the workplace. Companies are expected to produce new products and services and revisions to existing products and services multiple times per year to keep pace with the expectations of consumers. Regardless of industry or subject area, the perceived drive for creativity and innovation in the marketplace continues to rise.

Due to the global nature of knowledge and the interconnectedness of national economies in the 21st century knowledge-based economy, student preparation is being prescribed by IKBs, and "educational brokers" – e.g., transnational corporations, civil society organizations, credit rating agencies, consultancies, and public-private partnerships – (Jules & Jefferson, 2016) through different education governance mechanisms, – such as knowledge-based mechanisms, hybrid mechanisms, performance-based mechanisms, and extra-territorial mechanisms – which are regulated by the so-called 21st century learning frameworks (Dede, 2010; Jules, 2016; Robertson, 2005; Verger, 2009; Voogt & Roblin, 2012). Thus, these global entities endorse and prescribe frameworks around learning competences that students should achieve to be successful in the knowledge-based economy of the 21st century (Dede, 2010; Voogt & Roblin, 2012). The validity of this assertion is the inflection point for our study. By juxtaposing the learning competences prescribed within international frameworks against the competences evaluated by international assessment frameworks, this study examines the degree to which there is alignment between what is being prescribed and what is being assessed.

In what follows, we will first give an overview of international assessments and its linkage to education governance. Next, we briefly review the existent literature on human capital theory in the context of the knowledge-based economy and its link to 21st century competences in an era defined by integrated and capital markets. After this, we explain in detail our methodology and findings based on a comparing 21st century learning competences, as identified in international frameworks, against the 2015 testing frameworks outlined in two global international assessments – Trends in International Mathematics and Science Study

(TIMSS) and Advance and the Programme for International Student Assessment (PISA). In the concluding section, we sketch out some preliminary conclusions on creativity in the knowledge-based economy that argue the necessity for a precise definition of creativity and its role in innovation in every industry and, by extension, every academic subject area.

International Assessments and Education Governance

Western capitalism shapes today's knowledge-based economy, and its educational developments have been formed by neo-corporatist techniques that have hollowed-out the post-colonial bureaucratic state. In fact, the use of new public management techniques (NPM) across national educational sectors to engender efficiency and productivity has given rise to the post-bureaucratic state that calls on national educational systems to develop global minded citizens with 21st century skills. The application of NPM techniques to national education systems has given rise to several types of governance of education that are being structured by and under the "global education industry" (Verger, Lubienski, & Steiner-Khamsi, 2016) as the post-bureaucratic state emerges. Within the post-bureaucratic regime or organization, binding decisions are made strategically – which unifies all parts of the system producing binding pronouncements and proving active collaboration with others (Heckscher & Donnellon, 1994; Jules, 2015). This new space in which educational policy now exists is defined by the shift towards transnational modules of governance where the state now "defines objectives and oversees maintenance of the system management [...] [and] no longer wants to be seen as the sole provider of legitimate instruction" (Maroy, 2009, p. 78). As Maroy (2009) noted, the post-bureaucratic state has given rise to two models in education governance (i) the quasi-market state – which emphasizes that competition in education expands the service delivery options; and (ii) the evaluative state – where results-driven schemes are linked to rewards and sanctions (see also Straubhaar, 2016). The knowledge-based regulations of education have given rise to the post-bureaucratic educational state since educational brokers have an enormous amount of influence upon national policy-making.

The shift towards this mode of education governance within the post-bureaucratic states suggests that (i) the Weberian legal-rational model, which advocates formal organizational structures and mechanisms, is declining, and (ii) there is a tendency towards regional institutional mechanisms steeped in collaboration, cooperation, diplomacy, and implementation (Jules, 2016). This implies that with the growth of horizontal governance structures and processes, educational assessments are now global rather than national endeavors that are driven by competition. Within the post-bureaucratic state, we see the increasing datafication (Ozga, 2009; Resnik, 2016) of "evidence-based" and "evaluative state" models of policy-making decisions that rely on league tables, rankings, and other international comparative target achievements (ICTAs). Examples of ICTAs are the International Evaluation of Educational Achievement (IEA); International Adult Literacy Survey (IALS); Programme for International Student Assessment (PISA); Programme for the International Assessment of Adult Competencies (PIAAC); Progress in International Reading Literacy Study (PIRLS); Global Monitoring Report (GMR); First International Mathematics Study (FIMS); Second International Mathematics Study (SIMS); Trends in International Mathematics and Science Study

(TIMSS); and Teaching and Learning International Survey (TALIS) (Rogers 2014). Additionally, the World Bank, the Centre for Educational Research and Innovation (CERI), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations Development Programme (UNDP) produce their own comparative education surveys and reports that all serve to reinforce the development of global education industry and competitive targets.

International assessments are big business today and they can sway policy planners, educational officials, and nation states. The standardized comparison that ICTAs produce is good for spurring nationally contested reforms or certifying existing reforms. In fact, ICTAs serve as a platform for "reframing 'best practices,' 'international standards,' '21st century skills,' or other vague concepts in ways that fit local policy agendas" (Steiner-Khamsi, 2016, p. 162). At the center of the indicators that ICTAs use, there is the growing influence of educational brokers who will often recommend neoliberal education governance mechanisms as policy solutions. In recent years, the internationalization of ICTAs, particularly TIMSS and PISA, has given rise to greater competition as educational brokers now "reaches beyond traditional borders and national and regional identities of its member countries" (Pereyra, Kotthoff, & Cowen, 2011, p. 2) with best practices. Thus, OECD-driven schemes such as TIMSS and PISA have emerged as the vanguards for the "governing of knowledge" (Ozga, 2009) using performance information schemes that favor some countries, such as Finland, while putting reform pressures on other counties who are placed at the bottom of these voluntary rankings. This suggests that education governance is now linked to educational performance indicators and benchmarked through quality assurance and evaluation (QAE). Thus, education governance is being shaped through data and "comparison for improvement against competition has come to be the standard by which public systems are judged" (Grek et al., 2009, p. 120).

In this way, 21st century skills such as creativity have now emerged as part of a quadrantile of competences that are defining the movement from the knowledge-based economy towards the "intelligent economy" – the mastering of strategic information, economic security, and influence (Revel, 2010). This movement is driven by the emergence of the General Agreement on Trade in Services (GATS), particularly Mode 4 that targets labor mobility, and the subsequent transition toward servitisation – the drive toward "product-as-a-service providers" (Jules, 2016; Probst, Frideres, Cambier, Ankeraa, & Lide´, 2016). The evolution of the so-called 21st century skills that place greater emphasis on the development of competences and knowledge as opposed to rote learning. This position evolved as it was the view of policymakers that school systems were not training the next cohort of creative leaders. As several scholars advance, the information age was in decline and the conceptualize age was dawning in an era defined as the "global war" for talent (Brown & Tannock, 2009; Pink, 2005). Young people began to experience new forms of socialization and social capital through ICT developments as the current century demanded a very different set of skills and competence, proponents such as 'Partnership for 21st Skills,' 'Common Core Group,' and 'the Teaching of 21st Century Skills Project' called for a greater emphasis on the competences linked to knowledge management. The principal argument of these pundits was that skills "cannot be taught independently, i.e., outside a particular knowledge domain such as those designated by traditional academic subjects, nor will students be able to apply such skills if they

lack the appropriate factual knowledge on a particular domain" (OECD, 2008, p. 6). In this way, a competence became defined as more than just a set of skills but was viewed as involving the "ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a context" (OECD, 2008, p. 8).

Earlier studies have emphasized that "well-designed creativity training programs typically induce gains in performance" (Scott, Leritz, & Mumford, 2004, p. 361). Yet, questions have been raised as to if creativity is domain specific or domain general (or something in between) (Baer, 2010). However, Baer (2015) argued that since creativity is domain specific, it must be assessed in that way. Others, such as Schmitz (2010, 2013), articulating the domain specificity of creativity distinguished three types of creativity (i) corporeal creativity or "expressions of the creator's inner states" MacKinnon (1962); (ii) hermeneutic creativity – the ability to adapt to situations; and (iii) analytical creativity. In other words, "corporeal creativity deals with atmospheres, hermeneutic creativity with situations, and analytical creativity with constellations" that must be added by the "domain-general factors that are necessary for creativity (e.g., intelligence, motivation, environment)" (Julmi & Scherm, 2015, p. 156). However, it is widely recognized that human capital within the workforce is pivotal and that organization competitiveness is driven by the innovation capacity and digital skills of its workforce.

Human Capital in Knowledge-based Economy

Investment in individual competences dates to the popularization of human capital theory in the 1960s which sought to link education to economic development and theories of modernization (Becker, 1962; Lauder, 2015). Human capital theory states that an increase in productivity is linked to better education, which in turn will afford higher earning power for an individual (Haddad, Carnoy, Rinaldi, & Regel, 1990; Lauder, 2015; Montenegro & Patrinos, 2014; Psacharolpoulos & Patrinos, 2004). At the same time studies sought to understand to what extent an empirically identifiable modern man exists and, if so, what qualities he possesses (Gusfield, 1976; Inkeles, 1969). By the 1970s, studies (Schultz, 1975; Welch, 1970) suggested that workforce productivity increased the overall productivity of the organization and thus increasing efficiency. However, missing from the earlier skillsets identified by human capital scholars, was the concept of creativity that dates to the emergence of the so-called 21st century skills framework. In fact, earlier studies that neglected the concept of creativity, concluded that a globally-applicable definition of the modern man exists and that the amount of formal schooling a man has is the single most significant indicator in determining his modernity score (Inkeles, 1969). As human capital gained traction, the necessity of education grew, which led to the proliferation of postsecondary schooling beyond what was already compulsory (Resnik, 2006; Walters, 2004). The acceptance of human capital theory globally is evidenced in the continued demand for higher education services (Breton, 2013; Spring, 2008; Verger, 2009). Nations are requesting these services to meet the demand of their citizens to improve their earning potential (Lauder, 2015; Spring, 2008; Tan, 2014; Verger, 2009).

As earlier studies were based on factory work and physical labor in the industrial economy, it follows that in the knowledge-based economy and society, the competences of modernity would shift to align with the new workplace requirements. Human capital theory

has been widely criticized. One such criticism is that of credentialism (Lin & Lin, 2011; Walters, 2004). Credentialism is the direct result of the proliferation of human capital theory. It is the ever-increasing demand for formal educational qualifications and certificates for employment (Lin & Lin, 2011; Walters, 2004). Credentialism proponents argue this is leading to over-qualification of skilled workers and driving a deeper divide between socioeconomic groups (Lin & Lin, 2011; Mgobozi, 2004). Further criticisms have been levied against the alignment of education and economy globally with the claims of an existing skills gap, whereby entry-level employment candidates are not presenting the skills that employers are seeking (Arum & Roska, 2010; Barber, Donnely, & Rizvi, 2013; Gergen & Rego, 2014; Kaka, Madgavkar, Manyika, Bughin, & Parameswaran, 2014; Mourshed, Patel, & Suder, 2014; Van Velsor & Wright, 2015; YouGov Survey, 2013). The fear is that without alignment between the competences being taught in educational institutions and the competences being requested by employers, either rates of unemployment and underemployment will continue to rise as more ill-equipped workers enter the workforce. or employers will be required to hire less qualified candidates and lose productivity due to higher training needs to teach the skills they were once requesting as a prerequisite for employment.

Governments have continued to stress the importance of upgrading human capital through the promotion of access to a wide range of skills and competences. However, employability and the necessary skills needed became linked to international benchmarking viewed as the "basis for improvement… [since] it is only through such benchmarking that countries can understand relative strengths and weaknesses of their education systems and identify best practices and ways forward" (OECD, 2006, p. 18). Such pronouncements have led to a sizeable increase in the number of countries, both in industrialized and emerging markets, participating in ICTAs. While Kamens and McNeely (2010) suggest that "by the end of the first decade of the twenty-first century, over a third of the world's countries will be using standardized tests to assess their middle school and high school student achievement" (p. 6), questions remain as how 21st century skills, particularly creativity is assessed. This cycle of demand for knowledge through education, dissemination of knowledge across geographic boundaries and implementation of knowledge in the workplace by economic actors has led to the emergence of the knowledge-based economy. Thus, today's career competences in the employment opportunities are the modern competences of the knowledge-based economy.

Methods and Findings

Using the terms organized thematically found in international organizations' 21st century learning frameworks (hereinafter international frameworks), this study outlines a content analysis of the international assessment frameworks to answer the research question: How are learning competences, particularly creativity as described and prescribed by international frameworks, aligned to the competences evaluated in international assessments in the knowledge-based economy? To answer this question, we chose a quantitative content analysis that enables text, in this case international frameworks, to be analyzed and compared in a quantifiable manner to ascertain its perceived meaning (Krippendorff, 2004; Neuendorf, 2017). In this way, our quantitative content analysis is "an empirically grounded method, exploratory in process, and predictive or inferential in intent" (Krippendorff, 2004, p. 1). By converting text into quantifiable objective

data points through content analysis, the unstructured nature of text becomes more easily compared between authors and documents, regardless of semantic variations. Hence, content analysis provides "objective accounts of what messages were intended to convey or actually contain" (Krippendorff, 2004, p. 2). The categories outlined in the international frameworks are the objects to which we determine the frequency and use of in the assessment frameworks. By comparing these two sets of documents using content analysis, the alignment between them should be ascertained.

To understand what is being taught and assessed in schools two international assessments – PISA 2015 and TIMSS Advanced 2015[1] – were examined. We focus on analyzing these two assessments since they provide a framework for explaining how different competences guide how teaching and learning unfold in the classroom. PISA 2015 and TIMSS Advanced 2015 were chosen to examine what these international assessments have to say about creativity since they were given by more than three-quarters of the current countries in the international system and are viewed as global benchmarks that dictate future educational agendas and reform priorities. Moreover, our aim was to holistically look at the evaluative criteria of these assessments and not to focus on their ranking nor the impact of ranking on national educational endeavors (Baird et al., 2011; Breakspear, 2012; Gillis, Polesel, & Wu, 2016; Knodel, Martens, & Niemann, 2013).

PISA, which is coordinated by OECD, was first conducted in 2000 and subsequently every three years after that. PISA tests the skills and knowledge of 15-year-old students worldwide. Today PISA counts 84 member countries and in 2015, 28 million students from 72 countries took the two-hour assessment in science, mathematics, reading, and optional assessments in collaborative problem solving and financial literacy that were offered. Since PISA aims to measure "performance and information about the learning environment" (PISA, 2017), we sought to assess how creativity, as a 21st century competence, is detailed in the suggested PISA curriculum and guidelines that member states follow in preparing students for the two-hour assessment. While the first TIMSS Advanced assessments were done in 1995 and then again in 2011, we chose this framework since TIMSS Advanced 2015 – which consists of Advanced Mathematics and Physics – evaluated students in their final year of secondary school, the same age that PISA assesses students.

These two assessments were chosen because they offer a varied international dataset. Moreover, as noted above, they were testing different competences and the aim was to see how these two international assessments evaluate one particular 21st century skill, creativity. The 2015 test frameworks were analyzed because of the stated minimal changes in methodologies of assessment of both tests from previous years. Due to this statement in both assessments' frameworks, it was decided that inclusion of earlier years' frameworks would be duplicative and could skew results. Both assessments focus on science and mathematics while PISA also included reading and, in 2015, financial literacy. The categories were defined by the international frameworks listed in Table 1 and were not mutually exclusive. Each international framework labeled competences clearly in its prescription. Those competences were aggregated for the purposes of this study and any duplicates, including synonyms, were removed. The result was the comprehensive list of 17 categories (Sundberg, 2017).

Of the 17 categories, two were not present at all in the assessments: perseverance and leadership. The remaining 15 categories were present at least two times in the assessment

frameworks. The five most referenced categories were academic mastery, adaptability, critical thinking, creativity, and problem-solving. Table 2 represents the frequency counts for the categories.

PISA's framework was more verbose and a longer document, therefore it accounted for more category references than the TIMSS framework. Both frameworks possessed the same four most frequent categories, albeit in a different priority order based on frequency count. Those four most referenced categories are academic mastery, adaptability, critical thinking, and problem-solving. The fifth most referenced category in the PISA framework is communication while it is creativity in the TIMSS framework. Table 3 and Figure 1 represent the frequency counts for the categories by assessment framework.

Table 1.
International competence frameworks

Title	**Author**	**Public Organization**	**Private Organization**	**Geography**	**Date of Publication**	**Abbreviation**
Assessment and Teaching of 21st Century Skills (ATCS)	Marilyn Binkley, Ola Erstad, Joan Herman, Senta Ra	University of Melbourne	Cisco, Intel, Microsoft	Australia, Finland, Singapore, US, Costa Rica, Netherlands	2012	ATCS
ISTE Standards for Students	Susan Brooks-Young	The International Society for Technology in Education (ISTE)	None	Unspecified	2016	ISTE
Measuring 21st Century Competencies	Jim Soland, Laura S. Hamilton, Brian M. Stecher	Asia Society	RAND Corporation	Asia, United States	2013	Asia Society
Digital Transformation: A Framework for ICT Literacy	None given	International ICT Literacy Panel	Educational Testing Service (ETS)	Unspecified	2007	ETS

Overview of 21st Century Competencies and Skills	Maria Laura Munoz Villanueva	Asia-Pacific Economic Cooperation (APEC)	None	China, Chinese Taipei, Hong Kong, Australia, New Zealand, Japan, Brunei Darussalam, U.S.A, Thailand, and Peru	2008	APEC
Key Competences for Lifelong Learning	None given	European Union (EU)	None	European Union	2007	EU
21st Century Skills and Competences for New Millennium Learners in OECD Countries	Katerina Ananiadou, Magdalean Claro	OECD	None	Australia, Austria, Belgium, Canada, Finland, Ireland, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Turkey	2009	OECD

Table 2.

Competence search results

Category	**Frequency**
Academic Mastery	23
Adaptability	25
Collaboration	2
Communication	14
Creativity	15
Critical Thinking	26
Decision Making	14
Global Awareness	3
ICT Literacy	2
Information Literacy	13
Intrinsic Motivation	4
Leadership	0
Life and Career	7
Lifelong learning	4
Perseverance	0
Personal and Social Responsibility	13
Problem Solving	26

Table 3.

Competence search results by international assessment frameworks

Category	**PISA 2015 Framework**	**TIMSS 2015 Framework**
Academic Mastery	15	8
Adaptability	17	8
Collaboration	2	0
Communication	12	2
Creativity	11	4
Critical Thinking	22	4
Decision Making	11	3
Global Awareness	3	0
ICT Literacy	2	0
Information Literacy	12	1
Intrinsic Motivation	4	0
Leadership	0	0
Life and Career	7	0
Lifelong learning	4	0
Perseverance	0	0
Personal and Social Responsibility	13	0
Problem Solving	19	7

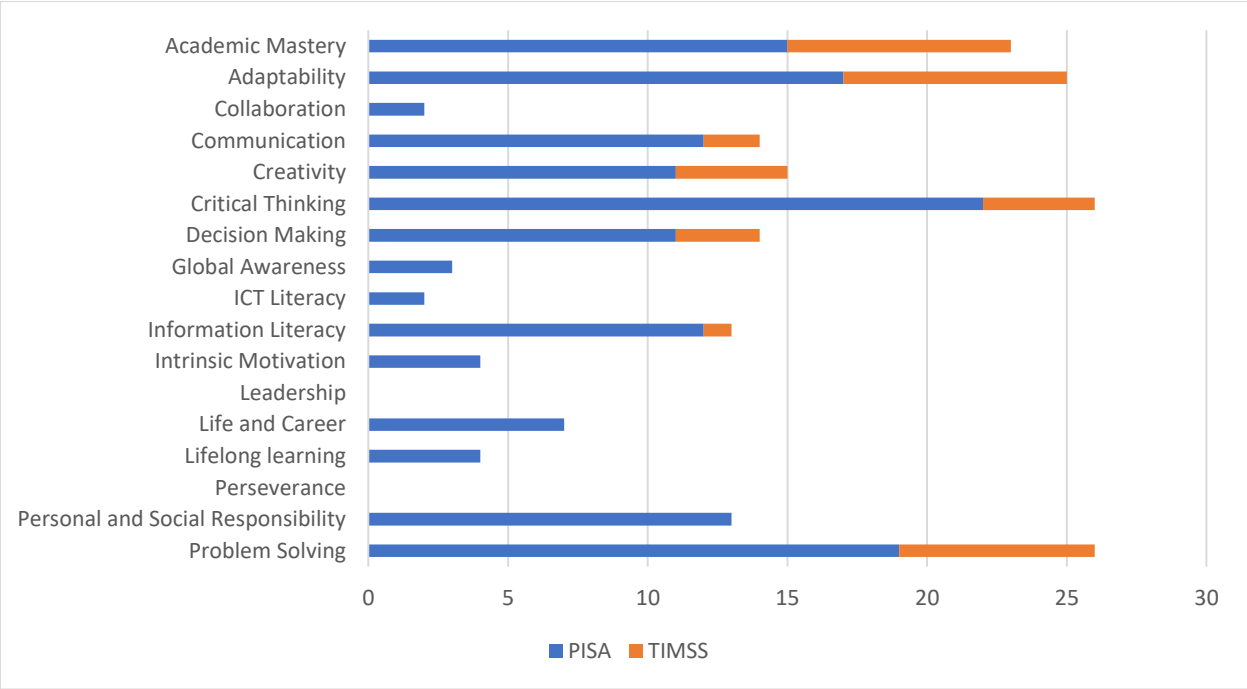

Figure 1.
Competence search results by international assessment frameworks

Discussion and Conclusion

While creativity is referenced frequently in the assessment frameworks examined, its use is unconventional due to the nature of the subjects being assessed. This supports the existing tensions in the field as to whether creativity should be domain specific, domain general, or something in between (Baer, 2010). Mathematics and science are quantitative subjects with objective realities, which can be clearly assessed using standardized rubrics to ensure accurate and consistent evaluations. Creativity, by contrast, is thought of as subjective and qualitative. Creativity stems from the word create, as in from an original idea or expression or classified as a "way of thinking" (Binkley et al., 2012), "digital competence" (Ferrari, 2012), "learning skill" (Partnership for 21st century skills, 2008). Thus, these assessments highlight that creativity is both conceptual and operational and that it can be defined as having "the skills to use ICT to generate new or previously unknown ideas, or treat familiar ideas in a new way and transform such ideas into a product, service or process that is recognized as novel within a particular domain" (van Laar et al., 2017, p. 583). In assessing science and mathematics, the use of creativity in the assessment frameworks often references the formulation of a hypothesis or formulation of an equation. Moreover, what it means to be creative in the context of the 21st century skills and learning is not defined nationally but internationally by global educational brokers who are the curators and legitimizers of the intelligent economy. Today educational brokers are responsible for the growth and diffusion of national and international assessments and are part of what Kamens and McNeely (2010) call the "international movement to rationalize — and standardize — educational systems" (p. 15). Today, workers are expected to possess skills needed to function in the national and global knowledge networks and innovation system since companies expect that national educational systems will supply the skills

requirements matched to match labor supply and demand.

The analysis shows that creativity, while not one of the top three priorities for either PISA 2015 and TIMSS Advanced 2015, is still in the top half of competences expected the assessments measure. This evidence is surprising, given that both assessments focus on math and science, which is not commonly associated with fostering creativity. However, using the literal definition of creativity, in which something is created, the subjects prove to encourage such activity by supporting the creation of hypotheses and the formulation of complex equations to determine the solution to a problem. This implies that international assessments, though the focus on math and science, view creativity as critical for both people and organizations if they are to keep abreast with the latest advancement in their field and innovate products and processes. The changes brought on by digitization in today's ICT-denominated global economy implies that creativity is expected across all job and economic environments, be it the tradition economy – full-time workers; the 'freelance economy' – the ability of employees to work remotely or from home; the 'gig-economy' or 'agile economy' – temporary and flexible jobs for independent contractors; the 'open talent economy' – the use of networks and ecosystems; the 'sharing economy' or 'collaborative economy'– the ability to temporary rent or borrow the assets from peer-to-peer; and the 'on demand economy' or 'access economy' – capacity to access products and services. While these various economies overlap with each other, our findings reaffirm that as innovation accelerates there is going to be a demand for talent pools and systems that are driven by creativity.

The language used in the assessments varies considerably from the language employed in the international frameworks. This difference in discourse is extremely important, as the language being used in classrooms is not the same as is being prescribed. Students struggle to understand the cross-curricular applicability of skills, as is made apparent by often heard statements like, 'Why do I need to know this?' The language used in classrooms is the language that students use in self-talk in their world, including after graduation. It is imperative, therefore, that the discourse chosen to describe skills are the words students should use themselves. In this way, creativity needs to be clearly defined and broadly applied when used in education. Its relevance and applicability span all subject areas but often in discussions, its focus is limited to the arts. Students need to understand when and where creativity can be applied and is necessary for every subject area, to foster innovation in all industries. With the rise of the use of Big Data, artificial intelligence, and machine learning in today's workplace, workers are now excepted to not only have the skills to select knowledge from the vast amount of information that exists, but they are also expected to use it selectively and efficiently in making decisions.

In summary, automation and cognitive computing are changing how we work, and organizations are redesigning jobs around these new systems, and the traditional "essential human skills" (Knowles-Cutler & Lewis, 2016) are giving way to data driven organization change. This study set out to identify the extent to which creativity is being taught and assessed, as demonstrated by the international assessment frameworks, as opposed to the degree to which it is being prescribed as a learning competence by the international frameworks. Due to the nature of the assessments and the quantitative subject areas they focus on, it was hypothesized the creativity would not be a priority in the assessments. However, it was found that creativity was a higher priority than hypothesized. With the movement from the knowledge-based society and the changing role of information communication towards the so-called intelligent economy, creativity will

become the most dominant of the current 21st century skills as the new economy requires the ability to manage information that is generated for Big Data and the datafication of confidential information. Unlike the knowledge-based economy that prizes information as a type of cryptocurrency, today's intelligent economy is stitched together by the web of communications (such as social technologies, Big Data, machine learning, mobility, and cloud computing) that have emerged during the last decade and is defined by the ability of individuals to predict fast-paced changes and personalized consumer demands that are shaped by capricious market forces. The sort of creativity that will be needed to harness, distill, and re-collate data is beyond the parameters of domain-specific creativity but requires students to have domain-general levels of creativity, something not found currently in international assessment frameworks but something that is demanded by companies. In other words, the skills needs will require individuals to be able to leverage and analyze the readily accessible vast volumes of data online to build new competitive data sets. Thus, creativity is needed to harness knowledge, and it is viewed as 21st century skills as it relatess more to needs of today's labor market systems than those required under an industrial mode of production.

Notes

1. The regular TIMSS, which also began in 1995, assess fourth and eighth graders in mathematics and science achievement every four years. However, like PISA, TIMSS Advance assess students at the end of secondary school and thus we chose both assessments as the present a good measurement to gauge workforce preparedness.

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