Rationale for KM Education and Training Beginning in Primary School

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Abstract: The paper identifies KM competencies by examining the unrecognized indications that KM concepts independently exist in educational systems. It suggests introducing KM education and training in primary, secondary, and vocational schools and a shift to specifying educational objectives based on competencies rather than subject. Qualitative approaches were used to identify omissions and needed clarifications in educational objectives by examining educational objectives, models, and guidelines. This paper "discovers" unnamed KM in today's educational systems. It provides definitions for competency terms for educational guidelines and identifies the foundational skills needed from both economic and social perspectives. It reveals long-standing definitional shortfalls that can be rectified by defining appropriate terms. It concludes by recommending a transition to competency-based concepts as guidelines. Competency terms for KM, all three of Bloom's domains, and the skills of making and doing, are required. Socialization needs for acculturation require amplification. KM education and training should be introduced in primary, secondary, and vocational schools to improve employability. Reviewed policy guidelines are limited to US and UK sources; other sources might provide additional insight. Socialization and science are not developed in competency word format. KM is discovered to be justified by educational guidelines, current curriculums, and unstated needs in educational objectives; justification does not rely on traditional KM sources. KM competencies complement other basic competencies in acculturating and preparing people for the modern workforce. Recognizing KM competencies as foundational competencies indicates that knowledge and KM topics should be included in primary, secondary, and vocational education and training. Collectively, the suggested terms more clearly identify competencies needed in a knowledge society and provide an alternative as guidelines to the subject approach currently used.

Keywords: knowledge management competencies, educational objectives, knowledge management education, educational competencies, theoretical research, multiple methods, qualitative research

(Includes extracts from poster abstract, Sisson & Ryan, 2016)

1. Introduction

The purpose of this paper is to suggest Knowledge Management (KM) competencies contribute to society's employability and acculturation goals and belong in required education subjects, as KM, beginning in primary school. Exploratory research using qualitative approaches into Knowledge Management (KM) concepts led to recognizing the need for a term similar to numeracy and oracy for KM. Discovering KM ideas in Bloom's Taxonomy of Educational Objectives (Seaman, 2011, Atherton, 2013) led to looking at educational objectives and educational guidelines and curriculums. Comparing requirements in them indicates KM activity in them, although, the need for KM as such has been unrecognized in those educational venues. In addition to KM being needed, the authors also found lack of specificity for some current educational competency terms and unrecognized indications of other competency needs as well. For completeness, another objective of this paper is to better specify foundational educational competence objectives and introduce them into the academic body of knowledge – particularly KM. Since reviewed policy guidelines are limited to US and UK sources; other sources might provide additional insight. Also, socialization and science are not developed in competency word format. Interestingly, KM can be justified by the educational sources without KM sources or discourses about the knowledge economy. KM competencies, as KM, should be added to primary, secondary, and vocational school curriculums.

These ideas flowed from an investigation into KM domain terms that surfaced 1000 words, none of which appeared would serve as a term for KM competency. This paper follows the introduction with a background section pointing out that redefinition of educational objectives is not uncommon. The methodology is discussed next in section 3. Figure 1 shows how many of these ideas fit together and are presented in this paper. Bloom's Taxonomy of (Evaluation – authors) Objectives and other concepts provided the initial basis for

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further investigation. In section 4.1 they are identified and compared in the context of further unrecognized indications that kinesthetic (psychomotor), affective, and knowledge accumulating skills are needed. Bloom's taxonomy leads logically to looking at guidelines and curricula for schools. In section 4.2, these guidelines are examined to provide a perspective on society's current assessment of needs based on implementation. They support the idea of products and reveal the need for knowledge organization. Guidelines also surface an indication of the need for KM mediums of which Gleick and Shapiro (2011) provided the stimulus for recognizing, McElroy (2002) called out, and Altheide and Snow (1979) address from a media theory perspective (Sisson and Ryan, 2016b). The concept of KM competencies leads to the idea of adding KM topics in primary school.

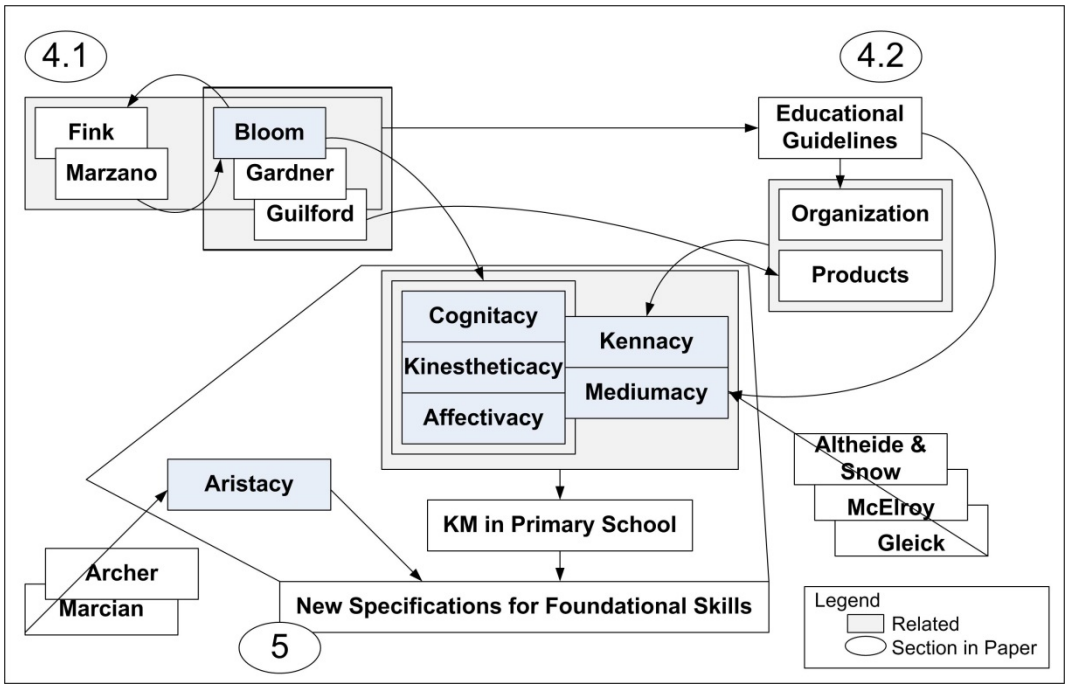

Figure 1: Relationship of ideas and partial organization of paper

Theoretical sampling led to discovering Archer and a basis for his arguments as far back as Marcian in the middle ages (Birch and Hooper, 2013-2016). Re-envisioning Archer's (1978) analysis, artistacy is tentatively suggested for making, and doing. Besides the fact that KM is addressed piecemeal and other educational terms are missing. Besides cognitacy, kinesthetic and affective, making and doing, organizing, and accumulating skills competency terms are needed. Also, as a by-product of looking at education guidelines, a need to clarify linguistic abilities terms and address science and socialization was determined. Section 5 of this paper briefly discusses these concepts as they are introduced as needed foundational competencies. Figure 2 shows how these competencies fit together in developing skills for employability and becoming well acculturated. These new terms are defined in table 1. Section 6 discusses other implications which leads to table 4 that contains a partial list of components of a possible Taxonomy of Educational *COMPETENCY* Objectives. Lastly, this paper summarizes the findings, recommendations, and suggestions for future research.

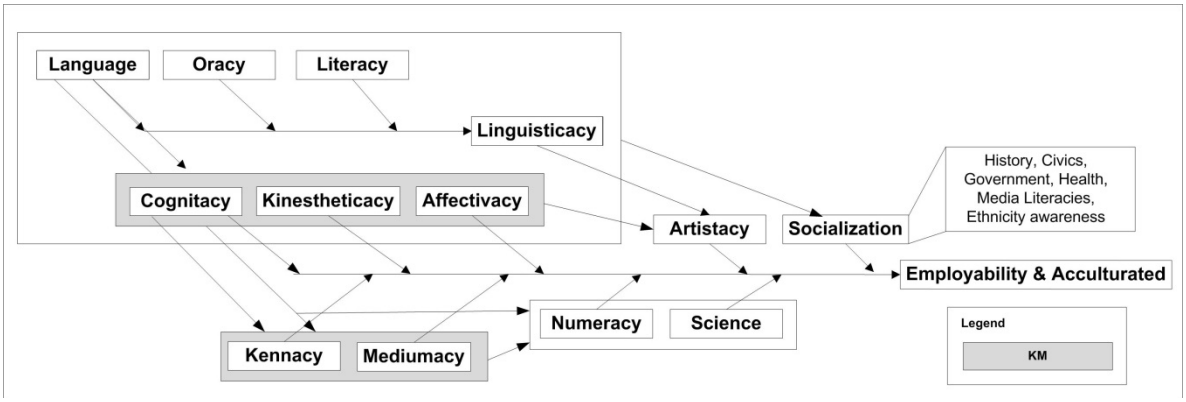

Figure 2: Strawman competencies dependencies diagram

Note: Extracted from Sisson and Ryan (2016c), Sisson and Ryan (2016d), Sisson and Ryan (2016e); legend added.
Note: Definitions in table 1.

KM education, in particular, should no longer be relegated to graduate programs alone, or as suggested by Bedford (2013), added just to "high school, technical schools, … and at the undergraduate level." KM education and training needs are justified for primary schools and should, by extension, also be included in secondary, and vocational schools' curricula as well.

2. Background

This section begins by pointing out that perceived learning needs change overtime. It presents early educational partitions to which current needs trace. Then it discusses driving needs and brings out the more modern additions of numeracy and oracy as a basis for explaining why KM is now needed.

The recognition that learning requirements evolve along with changes in economic structure and the needs of society is not new. "Martianus Capella (Marcian) (fl 410-39)" wrote nine books of which "the last seven are an allegorical encyclopaedia of the Seven Liberal Arts" (Birch and Hooper, 2013-2016). These became the trivium and the quadrivium - medieval names for two groups of studies (Drabble et al., 2007-2013, Stevenson, 2010-2017).

In a world dominated by agriculture, modern concepts such as employment had no meaning. For the vast majority of people, who lived on farms, the members worked according to capability and expectations. It was meaningless to say that one was "employed," just as it was meaningless to say one was "unemployed." There were obviously other occupations than farmer, such as merchant or barber, but these were not enumerated in any measure of economic activity. With the emergence of the industrial age, the development of sophisticated methodologies such as measures of productivity, and the evolving view of human activity as countable elements of the work product, delineations of skill sets that contributed to increases in capacity and capability were sought. These delineations include the concepts of literacy, numeracy, and oracy, all of which flow directly from the needs of economic engines. "Global economic, technological and social changes under way, requiring responses from an increasingly skilled workforce, make high quality educational provision an imperative" (Rowe cited in Stanley, 2008, p. 1).

Table 1: Necessary concepts for discussing and specifying foundational skills

Missing Skills		Competency		Has Skills
Inaffectivate	Not able to express or actualize feelings.	Affectivacy	Able to express and actualize feelings.	Affectivate
Inartistate	Not able to make or do.	Artistacy	Able to make or do.	Artistate
Incognitate	Not able to apply knowledge or reason. [A]	Cognitacy	Able to apply knowledge and reason.	Cognitate
Inkennate	Not able to accumulate or organize knowledge.	Kennacy	Able to accumulate and organize knowledge.	Kennate
Inkinestheticate	Not able to imitate or interpret bodily (i.e. physically).	Kinestheticacy	Able to imitate and interpret bodily (i.e. physically).	Kinestheticate
Illinguisticate	Not able to understand or use language.	Linguisticacy	Able to understand and use language.	Linguisticate
Illiterate	Not able to read or write.	Literacy	Able to read and write.	Literate
Immediumate	Not able to represent, store, or communicate knowledge.	Mediumacy	Able to represent, store, and communicate knowledge. [E]	Mediumate
Innumerate	Not able to reckon or figure.	Numeracy	Able to reckon and figure.	Numerate
Inorate	Not able to hear [D] or speak.	Oracy	Able to hear and speak.	Orate
Inmediate	Not able "to use or interpret media."	Mediacy	Able to use and interpret media [B C].	Mediate
Computer-illiterate	Not able to use or maintain computing technology.	Computer literacy	Able to use and maintain computing technology.	Computer-literate [F]

[A] Seaman (2011) and Atherton (2013) break the original six of Bloom's cognitive domain into two halves: a "lower order (knowledge, comprehension, application) and higher order (analysis, synthesis, evaluation) thinking skills" – or using and reasoning.
[B] (Buckingham, 2003, p. 36, Mitchell et al., 2003-4, Hobbs, 2005, p. 866, Kamerer, 2013, p. 5)
[C] Not just the mass media, but often in interpretation just the mass media.
[D] For generalization, comprehend (hear), not merely give attention to (listen as originally coined); includes pseudo hearing like from sign language.
[E] For this context, mediumacy mediums are defined as ones that can be used for the representation and storage and/or communication of knowledge.
[F] Not foundational, but provided as an example of one of today's common subjects.

Note: (Sisson and Ryan, 2016a, Sisson and Ryan, 2016e, Sisson and Ryan, 2016c), minor changes

We have seen the invention of the concepts of literacy in 1880 (Oxford English Dictionary, 2011-2017), numeracy in 1959 (Allen, 2008), and oracy in 1965 (Wilkinson, 1970) to reflect the changing needs of society. Naming these concepts and defining them operationally allows educators to systematically address needs, individuals to self-assess their readiness to participate in an economic activity, and employers a way to understand the required skills of the workforce appropriate to the job. KM to KM practitioners seems to be an important skill in a knowledge society. This paper shows that its need is reflected indirectly in educational system documents as well and should be a named competency so it can be better addressed.

3. Methodology

Multiple methods were used to reach the observations presented. Qualitative methods were used to first identify 1000 common words in the KM domain (Sisson and Ryan, 2016f). Reviewing research memos from that phase indicated that Bloom's Taxonomy of Educational Objectives (Krathwohl et al., 1964, Krathwohl, 2002) might be a good place for further exploration. Upon investigation, Bloom's cognitive domain appeared to already address two KM skill needs (Seaman, 2011, Atherton, 2013), Bloom's Taxonomy of Education (Evaluation) Objectives was selected as the seed for further investigations. Again, qualitative methods were applied to surface assessments and alternatives. Comparing related "taxonomies," parsing, and reconciling competency ideas confirmed applying Bloom's to identify KM competencies and led to new ideas as well. Logic led to examining educational guidelines and through qualitative research (partly completed in step one) to other basic educational topics as well through open and axial coding. The concepts were sorted, two informal gap analyses conducted, and the resulting twelve concepts were tested in terms of explanatory power (figure 2). Competencies listed address the topics from the educational system identified in sections 4.1 and 4.2 as well as completeness in terms of KM competencies (Sisson and Ryan, 2016b).

4. Literature review

Unrecognized indications of a need for KM competency is revealed first in educational objectives and intelligence models. They show a need for knowledge use and reasoning about knowledge and identify a need for knowledge products. Current subjects in basic education, as typified by guidelines from the UK, the US, the US governor's Common Core, and the Commonwealth of Virginia (not a Common Core participant) specify a common set of subjects. Looking at educational practices, school curriculums list other subjects such as media literacies that are also commonly taught. These practices support recognition of needs for KM and the other competencies identified during this research.

4.1 Educational objectives and intelligence models.

Several models of educational objectives and intelligence in the last six decades address similar concepts and point to the existence of KM from a skill perspective Bloom, supported by Marzano and Kendall, and Fink, identifies three areas in which to measure knowledge. Gardner resonates with them from a different perspective and Guilford's work brings forth the idea of knowledge products.

Bloom's *Taxonomy of Educational Objectives* (1956, revised 2001) helps educators prepare courses of instruction to test for knowledge (Krathwohl, 2002, Bloom, 1956, Krathwohl et al., 1964, Lasley, 2010, Dave, 1967, Simpson, 1966, Harrow, 1972). Bloom's first handbook published in 1956 was for the cognitive domain. Often encapsulated in the term Bloom's taxonomy are the affective domain developed by Krathwohl in 1964 and the psychomotor domain developed by Harlow in 1972. (Simpson published a psychomotor domain in 1966; Dave in 1970. (Krathwohl, 2002)) Whether factual knowledge as in the cognitive, ability to reproduce movement in the psychomotor, or awareness of others and self in feelings, etc. in the affective domain, the models are ways to think about assessing competence at different skill levels.

Bloom's cognitive domain can be looked at conceptually as objectives for knowledge use (remembering or learning, comprehending and applying) and reasoning (Seaman, 2011, p. 34, Atherton, 2013). That fits with Atherton's viewpoint of a training partition where analysis, synthesis, and evaluation (reasoning) would only be required for more complete professional training (Atherton, 2013).

The psychomotor domain includes "behaviours which place primary emphasis on neuromuscular or physical skills and involves different degrees of physical dexterity" (Armstrong et al., 1970b, p. 22). Harrow's, Simpson's, and Dave's proposals, for the psychomotor domain have commonalities and differences (Simpson, 1966, pp. 25-32, Harrow, 1972, Krathwohl, 2002, Armstrong et al., 1970a, Dave, 1967, Rupani and Bhutto,

2011). [Armstrong references Dr. R. H. Dave in two locations in India. Others cite (Dave, 1970) in Armstrong. The paper authors were only able to find Dave in two German references.] Bixler (2007) provided an interesting summarization of their proposals for the psychomotor domain as observing, imitating, practicing, and adapting. Note that these objectives look to determine memory, reproducibility, and interpretation of movement. None of these terms in the kinetic sense appears to directly address how to record the knowledge (musical notation, ballet positions, physical conditioning, etc.).

The affective domain addresses interpersonal and intrapersonal understanding about "emotions, attitudes, appreciations, and values" (Moore, 2001, p. 57). It is about degrees of sophistication in knowing about feelings (personal knowledge), and dealing with them appropriately (Jackson, 2006, p. 35). The affective domain is related to Gardner's interpersonal and intrapersonal intelligences and Fink's human dimension (Soulsby, 2011).

Bloom's three knowledge domains point to aspects of common, previously unnamed skill sets which the authors call cognitacy (Seaman, 2011, Atherton, 2013), kinestheticacy (Armstrong et al., 1970b, Armstrong et al., 1970a, Dave, 1967, Bixler, 2007), and affectivacy (Moore, 2001, Jackson, 2006).

"Marzano and Kendall (2007) and Fink (2013) built upon Bloom mirroring some of Bloom's proposed levels and adding new categories" (Sisson and Ryan, 2016f, p. 4). Fink's *Taxonomy of Significant Learning* (2003) collapses three of Bloom's cognitive domain levels into one and incorporates Bloom's affective domain (Fink, 2013) into another of her six categories (Robinson, 2009, Magnussen, 2008). Marzano and Kendall's *New Taxonomy of Educational Objectives* (2007) suggests thinking in two dimensions: six levels of processing and three knowledge domains (information, mental procedures, and psychomotor procedures) (Marzano and Kendall, 2007, kindle 469-477). "In the process, [Sisson and Ryan] think [Marzano and Kendall and Fink] moved from purely educational objectives to educating objectives while validating the former" (Sisson and Ryan, 2016f, p. 4).

Complementing Bloom, Gardner identified eight ways of individual thinking (multiple intelligences) (1983) (Colman, 2009-2014, multiple intelligences, Gardner, 2014, Strauss, 2013). Table 2 relates Bloom's, Marzano and Kendall's, Fink's, and Gardner's ideas visually. Columns contain the models and rows contain features important to them. By example, Fink's human dimension, Gardner's interpersonal and intrapersonal intelligences, and interpretations of Bloom's affective domain have common concepts. Marzano and Kendall generalize levels of mental processing and also address the motivational aspects of Fink's caring category.

Table 2: Bloom, Fink, Gardner and Marzano and Kendall concepts

<table>
<tr><td colspan="3">Bloom's Domains</td><td colspan="2">Other Models</td><td rowspan="2">Gardner (1983)</td></tr>
<tr><td>Psychomotor (1966 - 1972)</td><td>Cognitive (1956-2002)</td><td>Affective (1964)</td><td>Marzano & Kendall (2007)</td><td>Fink (2003)</td></tr>
<tr><td></td><td>Evaluation</td><td>Characterizing</td><td>Metacognition</td><td rowspan="3">Integration</td><td rowspan="2">Linguistics</td></tr>
<tr><td>Naturalization</td><td>Synthesis</td><td></td><td>Knowledge Use (KU)</td></tr>
<tr><td>Articulation</td><td>Analysing</td><td>Organizing and Conceptualizing</td><td>Analysis</td><td>Logical-mathematical</td></tr>
<tr><td>Precision</td><td>Applying</td><td>Valuing</td><td>KU (Apply)</td><td>Application</td><td rowspan="2">Spatial</td></tr>
<tr><td>Manipulation</td><td>Comprehension</td><td>Responding</td><td>Comprehension</td><td>Foundational Knowledge</td></tr>
<tr><td>Imitation</td><td>Remembering</td><td>Receiving</td><td>Retrieval</td><td></td><td>Musical</td></tr>
<tr><td colspan="2" rowspan="3"></td><td rowspan="3"></td><td rowspan="3">Self-system Thinking</td><td>Human Dimension</td><td rowspan="2">Bodily-kinesthetic</td></tr>
<tr><td>Caring</td></tr>
<tr><td>How to Learn</td><td>Naturalist</td></tr>
<tr><td colspan="2"></td><td colspan="4">Interpersonal & Intrapersonal</td></tr>
</table>

Guilford's mental abilities provide a seventh perspective - adding products (Colman, 2009-2014, Ruban and Cantu, 2005). Guilford's Cube, developed between 1946 and 1982, presents ""a multifactorial model of the structure of intellect (SOI)" (intelligence). "Usually depicted as an object loosely called a cube," each of the cells represents a mental ability with mental operations, mental representations, and product attributes. (Colman, 2009-2014, Guilford's cube) These ideas about different ways people think were an input to thinking about multiple intelligences, "in particular, those of Gardner, Sternberg, and Renzulli" (Ruban and Cantu, 2005, pp. 865-6). What Guilford offers, like Gardner, not observed in Bloom, Fink, or Marzano and Kendall is the idea

of products, although mental, as the output of knowledge processing. Guilford, Gardner, and Renzulli surface the idea of mental activity producing products (something that can and should be recorded). Products are one reason for the addition of the KM competency kennacy with operationalized functions accumulate and organize.

4.2 Current subjects in basic education

Subjects identified by society for implementation provide another perspective. These are discussed in ways. First, the topics specified in the guidelines are covered. Then the media literacies are examined. The merits and specific approaches (such as the Common Core) are not addressed, only indications of societal recognition of the importance of identified subjects.

The UK and the US, to pick two longstanding, developed nations, emphasize language skills, mathematics, and science (No Child Left Behind Act of 2001, 2001, Statutory guidance: National curriculum in England, 2014, Every Child Succeeds Act, 2015).

The US Governors' Common Core initiative re-identifies the need for education in "English language arts and literacy (ELA)," mathematics (CommonCore, 2013b), and other subjects (CommonCore, 2013a). Although being challenged, most of the states and "about 100 of 176 Catholic dioceses" adopted the Common Core standards (Layton, 2014). The Commonwealth of Virginia (one of the 4 states not to adopt the Common Core or part of its standards (Layton, 2014)) also requires similar subjects (Standards of Learning (SOL) and Testing, 2012-2014).

See table 3 for a comparison of subjects. In the table, vertical, logical columns represent standards examined for evidence of what is important. Labels for other subject areas differ, but relationships are shown horizontally. Linguistic ability, mathematics and science are important subjects in all four standards. Socialization, artistacy, kinestheticacy, and affectivacy show up in subjects taught.

Table 3: Educational guidelines that list needed skills

<table>
<tr><th colspan="6">Selected Guidelines</th></tr>
<tr><th></th><th>UK Standards</th><th>US [A]</th><th>Common Core</th><th>Virginia Standards</th></tr>
<tr><td rowspan="12">Subjects identified in guidelines</td><td colspan="4">Linguistic abilities [B]</td></tr>
<tr><td colspan="4">Mathematics</td></tr>
<tr><td colspan="4">Science</td></tr>
<tr><td>Design and Technology</td><td></td><td></td><td></td></tr>
<tr><td>Computing</td><td>Technology</td><td></td><td>Computer Technology [C]</td></tr>
<tr><td>Citizenship</td><td>Civics / Government</td><td rowspan="3">History and Social Studies</td><td rowspan="3">History and Social Studies</td></tr>
<tr><td>Geography</td><td>Geography</td></tr>
<tr><td>History</td><td>History</td></tr>
<tr><td>Art and design</td><td>Art</td><td></td><td rowspan="2">Fine Arts</td></tr>
<tr><td>Music</td><td>Music</td><td></td></tr>
<tr><td>Physical Education (PE)</td><td>Physical Educations</td><td></td><td>PE</td></tr>
<tr><td>Languages</td><td>Foreign Languages</td><td></td><td>Language</td></tr>
<tr><td></td><td></td><td></td><td>Other [D]</td></tr>
<tr><td colspan="5">[A] Minimums
[B] Language and literacy, English in the UK; reading or language arts in the US; English Language Arts/literacy in Common Core; English in VA. In the Common Core standard description, English Language Arts and Literacy is extended to include History/Social Studies, Science, and technical subjects, etc.
[C] "In the United States, media literacy skills are now directly or indirectly referenced in the learning standards for all 50 states" (Scheibe, 2007, p. 527) and are addressed in multiple categories shown.
[D] Economics and Personal Finance, Family Life, Health, Media Literacies</td></tr>
</table>

In addition, "a number of 'literacies' are emerging as the Information Age unfolds, including computer literacy, information literacy, media literacy, and visual literacy" (Hughes, 2004, p. 77). "Media literacy" "overlaps with many other types of literacy" … including these, plus "digital literacy, scientific literacy," "and cultural literacy" (Scheibe, 2007, p. 527). Computer literacy, technology, and education are also loosely specified. "For an individual, it simply means being able to use the computer as a means to an end" (Tidline, 2002, p. 162). But for some, it is correct application and use of "standard office applications, particularly word processing, spreadsheet, and database software" (Kamerer, 2013, p. 13). Others see it as an "understanding of physical devices and software" or purchase and management (Hughes, 2004, pp. 77-8). Some would include

"programming as well" (Sterne, 2003, p. 166). Additional complexity is added by concepts like programming in computer languages or information itself as a language (Bawden, 2007, p. 313, Gleick and Shapiro, 2011). Mediacy and "Information and Communications Technology (ICT)" (Buckingham, 2003, p. 95) skills can have learning objectives in the educational system. However, they could be treated as subjects applying the authors suggested basic competencies. Collectively, they point to a need for cognitacy, kinestheticacy, and kennacy as foundational skills.

5. Foundational skills

"The world of education is full of anomalies" (Archer, 1978, p. 4) which the authors of this paper attempt to address by looking at foundational skills from a new perspective. To begin with, the list and meaning of foundational skills in basic education needs clarification - first, because the definition of foundational skills in sources vary; second, because they are incomplete; and third, because in some case individual skills also need clarification.

Discussions and words used identifying foundational, basic, and key skills, etc. differ (Wallace, 2009, foundation subjects, 2014, section 3.5, Ragoonaden, 2013, p. 59, Williams, 2003, p. 10). This paper considers linguisticacy (language, oracy and literacy), numeracy, and artistacy are already well established as foundational skill needs (Newell and Looser, 2013, p. 752, Ragoonaden, 2013, p. 60, Heery and Noon, 2008, basic skills) literacy and numeracy as specified, oracy and "art" as observed in practice, and language as referenced in some documents. Figure 2 showed the suggested competencies in a herringbone diagram and indicates how the more basic ones contribute to the others. Science and socialization are important even if not truly foundational in terms of providing a basis for other competencies. The difference is not differentiated in this paper.

Cognitacy, kinestheticacy, and affectivacy are reflected in Bloom's Taxonomy of Educational Objectives, but not previously identified as needed knowledge management competencies. The additional KM competencies of kennacy and mediumacy also need recognition.

Artistacy from artistry (artistic ability) (Merriam-Webster, 2013-2017) is based on the word "art" instead of the word "Design" on which Archer (1978) settled in 1978 for making and doing. Socialization is a basic education goal; however, socialization components as well as the listed knowledge society skill requirements need identification. The sciences and scientific method are mentioned in this section, but not yet developed in a foundational competencies format. See (Gimbel, 2011) for an excellent investigation into "*the scientific method: cases and questions"* and the challenges such an undertaking will involve.

These competencies are discussed in groups beginning with linguistic ability, Due to the differing nature and evolution of the skills of the competencies discussed in the next sections, the approach and tone of the explanations also differ. Definitions were provided in table 1.

5.1 Linguistic abilities: linguisticacy (language, literacy, and oracy)

Historically, the terms linguistic ability, literacy, reading, writing, speaking, and listening have been inconsistently discussed. Understanding linguistic ability as an overall umbrella skill including grammar and vocabulary merits clarification. Literacy is sometimes narrowly defined – English (Statutory guidance: National curriculum in England, 2014), other times not (Australian Oxford Dictionary, 2004, literacy, Wallace, 2009, literacy), and sometimes contextualized outside of reading and writing as was shown in section 3.2 with the media literacies. Defining oracy as "speaking and listening" (Wilkinson, 1970, p. 73, 2009) provided a basis for removing overlap. Figure 2 showed the natural progression from language, preceding oracy, preceding (reading and writing) literacy as components of linguisticacy.

Language and linguistic ability go hand-in-hand. Linguistics is "the academic study of language" (Chandler and Munday, 2010-2016, linguistics); "English language arts/literacy" (CommonCore, 2013b). Grammar and vocabulary are key components of language: "the stock of words, pronunciation, and grammar used by a people as their basic means of communication" (Merriam-Webster, 2012-2016b, vocabulary). Grammar goes back centuries as it was a trivium topic. The Statutory guidance: National curriculum in England (2014 section 6.1), and the Commonwealth of Virginia in the following example, addresses the importance of correct terminology (vocabulary) (Standards of Learning (SOL) and Testing, 2012-2014) ("across the curriculum"

(DeMary et al., 2003, (language) UK Bullock Report, 1975 cited in McArthur, 2003, education) . In Virginia. this can be observed in correct names for body parts and terms like “central tendency,” from statistics, introduced in elementary school (Sisson, 2012).

Defining literacy (coined in 1880) as simply reading and writing, (Australian Oxford Dictionary, 2004, McArthur, 2003) is definitionally best. Adding English or another language is an often-included socialization objective (Wallace, 2009, Statutory guidance: National curriculum in England, 2014, CommonCore, 2013b, CommonCore, 2013a, Standards of Learning (SOL) and Testing, 2012-2014) which obfuscates the general concept.

Oracy traces back to ancient Greece and three senses for rhetoric (McArthur, 2003, rhetoric). Rhetoric was one of the three lower division (trivium) arts in medieval education (Blackburn, 2008-2016). While rhetoric now often has negative connotations (Buchanan, 2010-2016, rhetoric), it essentially “’is the Art of speaking suitably upon any Subject.’ (John Kirkby, A New English Grammar; 1746.)” (Waite et al., 2008, rhetoric). Oracy, adds the idea of listening (Wilkinson, 1970, p. 73) - "the skill of communicating clearly by speech, and of comprehending the spoken communications of others" (2009). While Wilkinson (1970) used the word listening, hearing has a more comprehending perspective. [“To perceive or apprehend by the ear” versus “to listen to with attention.” (Merriam-Webster, 2012-2016a, hear).] It is substituted in this article’s definitions (Merriam-Webster, 2012-2016a, Merriam-Webster, 2012-2016b, Waite, 2012-2017, Thinkmap, 2012-2017, Wallace, 2009, education). Despite being coined in 1965, oracy dictionary definitions are often still incomplete (Oxford English Dictionary, 2011-2017, oracy) or missing (Thinkmap, 2012-2017, Waite, 2012-2017).

Clarifying linguistic abilities as language (grammar and vocabulary), oracy (hearing and speaking), and literacy (reading and writing) unloads the meaning of the terms and is a first step in being able to specify foundational skill needs as competencies.

5.2 Numeracy and science

While numbers and logic are key to many disciplines, science depends heavily on numeracy. Numeracy has deep educational roots. Logic and arithmetic were topics in the trivium and quadrivium, respectively. While the lower division (trivium) were considered methodological subjects, the quadrivium subjects “comprise[d] the sciences” (Drabble et al., 2007-2013, quadrivium) establishing an early relationship between numerical operations and science.

Coined in 1959, numeracy is a "skill with numbers and mathematics" (Thinkmap, 2012-2017, numeracy), “the capacity for quantitative thought and expression” (Merriam-Webster, 2013-2017, numeracy) and “a term denoting competence with basic mathematical concepts” (Allen, 2008, numeracy).

Science is taught in primary education; however, science as a subject of study specification in educational guidelines often means biology, chemistry, and physics in secondary schools. Science as a general competency, even the scientific method, is a more difficult concept. Contrary to popular belief, there is no universal five or seven step scientific method (Gimbel, 2011, p. ix, Ramsey, 2010, p. 758, Haig, 2010, p. 1327). Carey (2011) mentions a basic three-step process (observation, explanation, and justification (experimentation) that summarizes the scientific method well. The authors use science as a term for a group of subjects that includes the “scientific method,” scientific approaches (Strickland, 2001, scientific method, Hyde, 2009, per wikipedia, Haig, 2010, Ramsey, 2010, Gimbel, 2011), and the physical sciences. Table 4 which summaries foundational competencies and identifies their components illustrates this.

5.3 Artistacy

Artistacy (the making, and doing of) traces back to music in the trivium. From an implementation perspective, beginning with show and tell (oracy), one sees the folders of art projects youngsters bring home that evolve into science projects in a few years. Early education in music broadens into performing arts. Vocational subjects like homemaking and shop (more so in past years) or broadcasting (nowadays) become part of the available curriculum as students advance. Making, and doing are well established in the reviewed educational guidelines.

Following the suggestions for numeracy in 1959 and oracy in 1965, (Archer, 1978) wrote about “an under-recognized but definable third area of human knowing, additional to numeracy and literacy” (p. 3) - making

and doing. Interestingly, he appears to have constructed a cited argument (Fletcher, 2001, Honey, 2005, Stevens, 2008) for attributing "reading and writing," "reckoning and figuring," "wroughting and wrighting" to his great aunt. [The authors have been unable to substantiate Archer's assertion. Evidence otherwise would be greatly appreciated.] Archer says she used the terms when saying that "Sir William Curtis" "had got it all wrong" when he "coined the phrase The Three R's' … - 'reading, writing and 'arithmetic" around 1807. In his analysis, Archer partitioned "the world of learning" into the humanities and science and "the world of action" into affairs (operational arts) and DESIGN (all caps, not Design) (creative arts). He selected Design (with a capital D) from Welsh usage because, while "the term 'the Arts' would be ideal," it was already being "used more or less as a synonym for, the Humanities" (Archer, 1978, p. 6).

Archer identified a needed educational competency as evidenced by music in the trivium and current primary school practices such as art projects and music. The authors think artistacy spanning Archer's "world of action" as the competence of making, doing is more appropriate. Earlier suggestions included creativity along with making and doing in artistacy (Sisson and Ryan, 2016a, Sisson and Ryan, 2016c, Sisson and Ryan, 2016e); however, creativity spans more that the "creative arts" and the operational arts such as the performing arts.

5.4 Cognitacy, kinestheticacy, and affectivacy

Bloom's Taxonomy of Education Objectives domains (cognitive, psychomotor, and affective) have been widely adopted as well as extended (Marzano and Kendall, 2007, Fink, 2013). Educators are encouraged to write objectives that show, by cognitive example, remembering, understanding, applying, analysing, synthesizing, and evaluating knowledge in a subject area. Looking at the terms generically, they represent kinds of skills in managing mental knowledge. Cognitacy, kinestheticacy, and affectivacy are terms that document these generic skills as competencies. Cognitacy is about thinking and thoughts management. Kinestheticacy is about reproduction of movement (as affectivacy is about feelings) not intellectual discourse about kinestheticacy, or affectivacy, mechanisms. Affectivacy has become more recognized as a need (without the specific name) as a result of horrifics like the school mass killings and recruitment of young people to be terrorists.

5.5 Kennacy and mediumacy

As previously shown, kennacy is an outcome of looking at educational objectives, intelligence models, and current subjects in basic education. Mediumacy is a competency concept necessary for a complete KM competency specification.

Viewed simply, Knowledge Management (KM) is accumulating and organizing knowledge – kennacy. It addresses the recording and organizing needs mentioned in section 4. Kennacy is as simple as obtaining a phone number and putting it in a phone directory. Sisson and Ryan (2016f) suggest that recognizing, retrieving, comprehending are typical components of accumulating knowledge as are categorizing, pooling, sustaining, and retiring are for organizing knowledge.

Mediumacy, along with cognitacy and kennacy, completes KM from a competency perspective. Mediumacy permits bunding diverse competencies such as information technology, people, cultural literacy, educational topics, etc. into a single concept. Kennacy (accumulating and organizing) combined with cognitacy (use and reasoning) and mediumacy (skill representing and storing and/or communicating knowledge) establishes a complete competency viewpoint for KM See (Sisson and Ryan, 2016b, p. 17) for an illustrative list of knowledge mediums such as IT portals, CDs, people, culture, microwave, and frameworks like the quadrivium and individual sciences Sub functions (verbs) for the mediumacy functions of representing, storing, and communication knowledge have not yet been identified. [Note: The research presented in this paper into educational objectives and guidelines preceded Sisson and Ryan (2016b), Sisson and Ryan (2016f), Sisson and Ryan (2016d). Verification of the operationalized functions of the Unified Theory of Knowledge Management (Sisson and Ryan, 2016f) represented by cognitacy, kennacy, and mediumacy is in progress.]

Integrating KM skills and teaching them offers a binding function for the application of them as taught separately by subject today. Understanding and applying mediumacy concepts offers a potential for new generalizations and information management in this era of information overload.

5.6 Socialization

In KM, socialization is often discussed as tacit to tacit knowledge transfer (Brock and Zhou, 2011, p. 1148) associated with the Nonaka knowledge creation spiral model (Nonaka, 1994, p. 20). More generally, "socialization is the process by which we learn to become members of society, both by internalizing the norms and values of society, and also by learning to perform our social roles (as worker, friend, citizen, and so forth)" (Scott and Marshall, 2009-2015, socialization). Socialization can also be outward in the promulgation of ideas (Wijnhoven, 2011, p. 1239) or is "the establishment of interactions between resources to improve the efficiency and effectiveness of capturing, transferring and sharing knowledge throughout the enterprise for economic gain" (Green and Ryan, 2005, p. 49).

Socialization acculturates (Stewart, 2006, socialization, Xu, 2010, Kinnucan-Welsch, 2010, Chandler and Munday, 2010-2016, socialization, Scott and Marshall, 2009-2015, socialization). Topics in citizenship, geography, government, history, and social studies using cultural artefacts (including mass media, etc.), contribute to a common understanding. For new participants in a society, it provides essential assimilation. Tolerance, especially in the US, is an important goal and diversity awareness could be a named competence under the socialization goal for such societies.

6. Discussion

The suggested educational competencies might also be able to be organized into a skills hierarchy. Language, oracy and literacy provide differentiation for linguisticacy. The levels in Bloom's Cognitive Domain address educational considerations in developing skills in a subject. While they could also be reinterpreted as generic KM skills that should be learned, Bloom's domain levels may need re-examination and some naming to be improved and provide such commonality if used for measures of expertise or KM skills proficiency.

Table 4 shows the above-mentioned competencies, along with artistacy, science, socialization, and some related actions with their current suggested components. The objective science includes competency in the basic scientific method of observe, explain, and justify (Carey, 2011, p. 3) as one part of scientific skills. Somewhat traditional explanations of the scientific method as five or seven steps is reflected in the syntactic views of the scientific method, particularly the hypo-deductive method (Gimbel, 2011) are shown. The traditionally taught physical sciences complete the science objective visualization. Science, as an educational objective, needs to be further investigated and needed competency terms identified. Socialization is represented by subjects and topic areas such as media literacies. Cultural awareness is reflected by listing iconic stories, media, and ethnicity awareness.

Table 4: Partial list of components of a taxonomy of educational competency objectives

Artistacy	**Linguisticacy**			**Numeracy**	**Justification**
Making	**Language**	**Oracy**	**Literacy**	Numerical operations	Verification
Doing	Vocabulary	Hearing	Reading		Validation
	Grammar	Speaking	Writing	Logic	Verication
	Socialization	**Science and Scientific Skills**			
	Iconic stories	*3 Steps*	*Viewpoints*	*Reasoning*	*Sciences*
Action	History	Observe	Syntactic View	Deduction	Biology
Show & tell	Government	Explain	Holistic View	Induction	Chemistry
Art	Economics	Justify	Semantic View	hypothetico-deductivism	Physics
Crafts	Media literacies				Biochemistry
Music	**Knowledge Management**				
Skits	**Kinestheticacy**	**Affectivacy**	**Cognitacy**	**Kennacy**	**Mediumacy**
PE	*Using*	*Using*	*Using*	*Accumulating*	*Representing*
Theatre	Perceiving	Perceiving	Remembering	Recognizing	-
Dance	Imitating	Responding	Understanding	Retrieving	-
Shop	Manipulating	Valuing	Applying	Comprehending	*Storing*
Homemaking	Precision	Organizing	*Reasoning*	Applying	-
Broadcasting	*Reasoning*	*Reasoning*	Organizing	*Organizing*	-
	Articulating	Conceptualizing	Synthesizing	Categorizing	*Communicating*
Largely (Archer, 1978)	Naturalizing	Characterizing	Evaluating	Pooling	-
				Sustaining	-
				Retiring	

While figure 2 shows potential dependencies in competencies development – language, then oracy followed by reading (literacy) is a typical educational developmental sequence – both linguistic abilities and KM are foundational skills required across the spectrum. Given that babies learn to turn over, sit up, and feed themselves early in their development, if figure 2 was reinterpreted to represent a sequence of human development, kinestheticacy would need to be moved to the left. However, in early educational settings, also teachers use words to instruct supporting the idea of language first underpinning learning. Only kinestheticacy and affectivacy may need literacy and linguistic abilities less than the other identified competences. However, all the non-KM competencies benefit from KM expertise. Artistacy and numeracy are also broadly needed skills.

7. Summary

This paper clarifies overlapping and overload educational competency terms by first bundling language, oracy, and literacy into linguisticacy, providing clarity for terms for hearing and speaking, reading and writing, and the underlying general concepts of vocabulary and grammar. Kinestheticacy was tied back to its physical nature by clarifying that inkinestheticate would be unable to imitate or interpret movement. The importance of affectivacy as a member of society was emphasized. Cognitacy is already embedded in the educational system through the application of Bloom's and others educational objectives approaches. Artistacy is at last named with appropriate scope (both the performing and creative arts (Archer, 1978)).

The ideas of media, information, and computer literacy, from an educational perspective, were found to be useful skills using multiple educational objective competencies (by example, reasoning and kinesthetic); yet they also lead to ideas of organizing, recording, and sharing knowledge (as information) as needed general skill sets. Kennacy, mediumacy, and socialization round out needed foundational educational skills and learning objectives. Mediumacy as an umbrella concept should be addressed in media literacy education. [See Sisson and Ryan (2016b) for the development of mediumacy and more information on mediacy and media literacies.] Socialization also supports the need to specify intrapersonal and interpersonal awareness and skills (affectivacy).

To provide specificity for current educational objectives, this paper suggests the terms: illinguisticate, linguisticacy, linguisticate, incognitate, cognitacy, cognitate, inaffectivate, affectivacy, affectivate, inkinestheticate, kinestheticacy, and kinestheticate (the last 9 from Bloom's Taxonomy) (Bloom, 1956, Krathwohl, 2002, Krathwohl et al., 1964, Lasley, 2010, Dave, 1967, Simpson, 1966, Harrow, 1972). Inartistate, artistacy, and artistate are suggested to broaden and replace Archer's term "Design" (1978). Inkennate, kennacy, kennate, immediumate, mediumacy and mediumate are suggested KM additions (Sisson and Ryan, 2016f). See table 2 which also clarifies inorate, illiterate, and innumerate definitions. Computer literacy is included in table 2 only as an example of a term for another important, but not foundational, skill.

Future research should potentially include whether the terms science and socialization can be generalized in terms of needed skills by developing competency terms for them. Diversity and alternative terms like ethnic awareness or sensitivity training (and appropriate boundaries) merit investigation. Creativity has not been added, but potentially should be. In addition, "All I really needed to know I learned in kindergarten" (Fulghum, 1990) suggests that socialization might be emphasized (as an indication of higher priority) from a needs perspective - especially for some types of disadvantaged children who may be socially as well as academically challenged.

Regardless, from a goals perspective, moving to educational objectives specified as abilities, skills, or competencies and using concepts that are more precisely defined is something that governments should implement. Building KM skills early, more formally than as piecemeal addressed in primary schools, and building upon those skills in secondary, and vocational schools can only improve individuals' ability to leverage knowledge and positively impact organizational KM capacity over time. In addition, identification and specification of these skills could help organizations identify deficiencies in their current workforce and put in place programs to correct them.

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