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The Role of Blended Knowledge in the Development of Creative Productive Giftedness

Joseph S. Renzulli
University of Connecticut, USA

Knowledge has no value except for that which can be gained from its application toward some worthy end.
Napoleon Hill

Our history and culture can be charted to a large extent by the creative contributions of the world's most gifted and talented individuals. What causes some people to use their intellectual, motivational, and creative assets in such a way that it leads to outstanding manifestations of creative productivity, while others with similar or perhaps even greater assets fail to achieve at expected levels of accomplishment? The sheer amount of folk wisdom, portrayals in popular media, and biographical and anecdotal accounts about creativity and giftedness are nothing short of mindboggling. Some clarity, however, can be found by carefully examining the creativity literature.

Creativity researchers, for instance, tend to agree that creativity is the combination of originality and task appropriateness as defined in a particular context (Plucker, Beghetto, & Dow, 2004). Moreover, researchers have differentiated among different levels of creativity, ranging from the more subjective (mini-c) to the everyday (little-c) experiences of creativity to professional (Pro-c) and finally, eminent (Big-C) levels of creativity (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009). Along these same lines, creativity researchers have also argued that although creativity can be experienced across multiple domains at lower levels of performance, high levels of creative production tend to be domain specific (Kaufman, Beghetto, Baer, & Ivcevic, 2010).

Even with these insights from creativity research, we are still unable to answer the fundamental question of how and why some individuals develop their talents and perform at superior levels in analytic, investigative, and creative ways. While it would be tempting to present a yet another "combination-of-ingredients theory" (based on the characteristics of giftedness) to explain why some people achieve at high levels, the theory described in detail in this article addresses how three interrelated levels of knowledge fit into the structure and quality of one's formal learning experiences. These levels are Received Knowledge, Analyzed Knowledge, and Applied and Created Knowledge.

The theory is based on the role that knowledge plays in developing an investigative mindset and creative productivity, and how the integrated use of three levels of knowledge contributes to a major goal of gifted education, which is to increase the world's reservoir of creative and productive individuals. This work is purposefully different from theories about the

characteristics of giftedness because it deals with the organization and structure of knowledge and it has implications for both curriculum development and teaching strategies that can be implemented in programs for gifted and talented students. These services represent a central focus of the literature in our field and what we actually do in programs that serve gifted students.

The field of gifted education is replete with systems and models for identification, curriculum development, program development, and program evaluation (Dai & Chen, 2014; Hunsaker, 2012; Renzulli, Gubbins, McMillen, Eckert, & Little, 2009; VanTassel-Baska & Brown, 2007) but little attention has been given to an underlying theory that focuses on the role of knowledge in the development of characteristics that bring high potential students to our attention. Just as flour, water, salt, and yeast are the main ingredients for making bread, so also are knowledge and the creative construction and application of knowledge the main "ingredients" for developing highly creative and productive bright young minds.

Epistemology

Theories of knowledge are the focus of the study of epistemology, that branch of philosophy that investigates the origin, nature, methods, construction, and diffusion of human knowledge. In the Western world, epistemology had its origin in the work of Plato and Aristotle, as explained in this elegant quotation.

> For Plato, sense data were at best a distraction from knowledge, which was the province of unaided reason. For Aristotle, knowledge consisted of generalizations, but these were derived in the first instance from information gathered from the outside world. These two models of human thinking, termed rationalism and empiricism, respectively, formed the major intellectual legacy of the West down to Descartes and Bacon, who represented, in the seventeenth century, the twin poles of epistemology (Berman, 1981, p. 46).

Bacon's approach to knowledge and learning became the standard for the development of the scientific method and for all subsequent taxonomic systems for organizing knowledge such as *Bloom's Taxonomy of Educational Objectives, Book I: Cognitive Domain* (Bloom, 1954; Anderson & Krathwohl, 2001). Bacon's taxonomic scheme set forth the paradigm for what has become the major guide for the pursuit of intellectual knowledge.

Bacon's theory states that knowledge comes primarily from sensory experience and evidence, especially through experimentation guided by six steps: (1) state the problem, (2) gather information/research, (3) formulate a hypothesis, (4) do the experiment, (5) analyze results, (6) draw conclusions (Machlup, 1980). Thus, Bacon's ideas on what has now become universally recognized as the scientific method have had serious implications for the basic ingredients of what we should be examining as an epistemological framework for developing giftedness in young people (Dick, H. G., 1955).

An interesting historical footnote about the theory discussed here is that the Ancient Greeks mentioned above never believed that certain types of knowledge were more useful than others! Rather, they argued that the advancement of understanding occurred when different types of knowledge worked together to enhance learning and wisdom. The advent of formal curriculum that emerged over the centuries resulted in content and process being treated as

separate pedagogical entities by subsequent education theorists. And when testing for content acquisition became the major criterion for measuring school success we moved away from the original concept of blended knowledge embodied in the Aristotelian and Platonic concepts of knowledge (Fitch, 1981). In a certain sense, the theory presented in this article serves as "connective tissue" between the ways in which the ancients viewed knowledge and the changes that have taken place in formal education. These changes have resulted in a clear dichotomy that has forced a distinction in learning theories among the three levels of knowledge around which the theory is structured. Modern day theorists in cognition and instruction (e.g., Bereiter, 2002; Bransford, Brown, & Cocking, 2000) have pointed to the changes that have taken place in learning theory as a result of the advent of the "knowledge age;" and this is the reason that a brief consideration of the *sources* of knowledge as well as the levels of knowledge have been integrated into account in the rationale of this theory.

The theory presented here simply intends to portray the ways that different kinds of knowledge interact with one another to produce the "blended knowledge" at the center of Figure 1. Learners receive information, but as they begin to analyze this information they may find it necessary to "go back" and gather more material to carry out an analysis. Similarly, when they reach the applied and creative stage, they may also need to return to the received and applied levels; and "return trips" to these levels are usually based on just-in-time rather than presented information. And in those cases when new knowledge, innovative contributions to a field, or even new ways of analyzing data (Big-C contributions) are made at the applied and creative level, the innovative person may be contributing content that becomes part of received knowledge. Although this process is the natural way that learning takes place, an overly standardized test-prep curriculum may severely emphasize received knowledge and in a certain sense "discriminate" against both the analyzed and applied/creative levels of learning. It is for this reason that the theory has relevance to the pedagogy advocated in special programs and the ways in which we train teachers to work with gifted students. The reason that gifted education advocates were among the educators who early on latched on to Bloom's theory of cognitive development was that it called attention to the higher mental processes important to high levels of development.

Bloom's work, however, has usually been interpreted as a lineal sequence to the pursuit of higher levels of thinking (not necessarily his intention). The Theory of Blended Knowledge presented in this article views knowledge acquisition and usage as an interactive and cyclical process and thus is presented in the form of a Venn diagram in an effort to portray this interaction (see Figure 1).

Before describing the Theory of Blended Knowledge that is the focus of this article, it is important first to discuss two related issues that are part of the rationale underlying this theory. These issues are important because the production and diffusion of knowledge is central to the advancement of our civilization and an important part of the rationale for establishing and supporting programs for young people with exceptionally high potential.

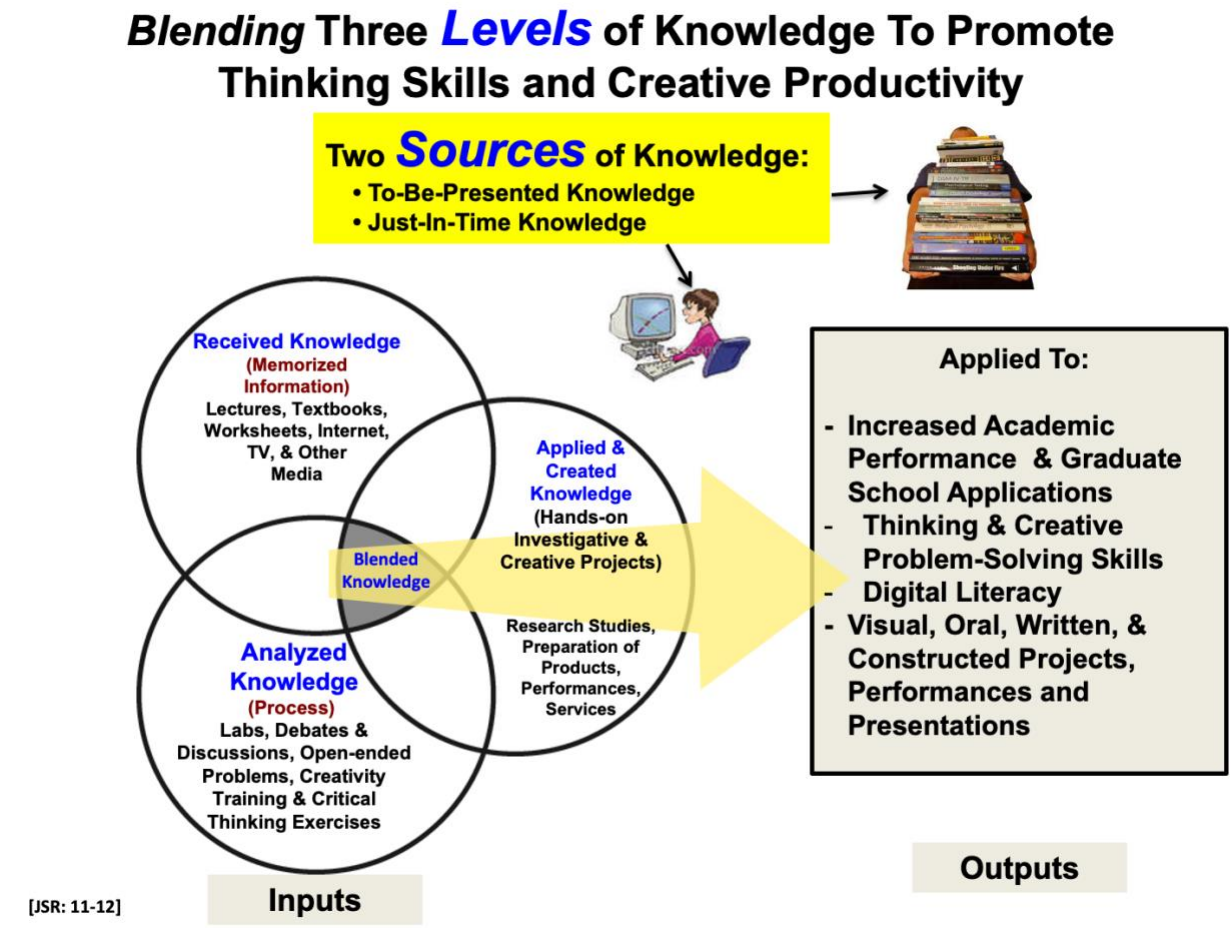

Figure 1: A theory of blended knowledge.

The Purpose of Gifted Education

The first issue is the justification for providing special services to the targeted group of young people served in special programs for the gifted. "Why," many people have asked, "should a school, state, or nation provide supplementary funds, specially trained teachers and teacher training programs, conferences, professional journals, and other resources for a group of students that are already endowed with superior potentials?" Although we often respond to this question by talking about the "needs" of these students that are sometimes met but more often not addressed, it seems apparent to state that all students in our schools have needs that should be respected and accommodated. Or we run down a list of our usual maxims (e.g., the need for creative thinking, critical thinking, problem solving, decision making, etc.), but leaders of a recent report entitled *21st Century Skills, Education & Competitiveness: A Resource and Policy Guide* (Partnership for 21st Century Skills, 2008) have argued emphatically that:

> Public education has traditionally thought of higher level thinking as the purview of talented and gifted programs, while the teaching of basic skills was geared toward those on a trade track in high schools. Now, the focus must be on making sure all students have a broad array of these skills in addition to strong grounding in core subjects (p. 27).

When asked the question addressed above about why we need special services for gifted and talented students, I have always stated unequivocally that the purpose of providing supplementary resources for the development of giftedness is to increase the world's reservoir of highly creative and productive individuals. Simply explained, we need more scientist, artists, writers, statesmen, political leaders, entrepreneurs, and designers in all fields of human endeavor who will address the problems of our modern society, improve the health, economy, quality of life, human freedoms, aesthetics, arts, and preservation of the Earth's resources. While this response may sound abstract and idealistic, it bears a direct relationship to the kinds of contributions that we admire in such gifted individuals as Jonas Salk, Ludwig Beethoven, Margaret Sanger, Pablo Picasso, Martin Luther King, Rachel Carson, Steve Jobs, Marion Anderson, and others who have left their stamp on making the world a better place.

Sources of Information and Knowledge

The second issue related to this theory has to do with the sources of information and knowledge for learners of all ages. Who and what are the providers of information and knowledge in formal learning situations? When it comes to schooling there are essentially two major sources of knowledge. I define the first source as To-Be-Presented (T-B-P) knowledge, the type usually transmitted to students through lectures, textbooks, and other forms of print, visual or auditory media. Committees that develop curricular standards and textbook writers almost universally determine what T-B-P knowledge is used in today's schools, and it is also highly influenced by persons who develop standardized tests. Most traditional learning is based on this source of knowledge.

I call the second source of knowledge Just-In-Time (J-I-T) Knowledge. This type of knowledge is described as the one that people only "go and get" because it is necessary to address a particular problem or to learn more about something assigned or that is of personal interest to the individual. The advent of technology and the Internet has now made access to J-I-T Knowledge ubiquitous to most teachers and students. Technology has also provided us with software that can personalize learning in a way never before available; and it can personalize learning beyond merely modifying the amount and level of content provided to students. Program such as Study Island [https://www.studyisland.com], Compass Learning [https://eompasslearning.com], Naviance [https://www.naviance.com], and a program called Renzulli Learning System (RLS) [https://www.renzullilearning.com] developed at the University of Connecticut (Field, 2009; Renzulli & Reis, 2007). The Renzulli Learning System creates an individual profile for each student based on his or her interests, learning styles, and preferred modes of expressions; and a unique search engine matches each profile to high engagement resources according to the ways students have responded to the questionnaire that generates the profile. Teachers can also use this software to review, select, and infuse high engagement enrichment activities into selected curricular topics or units of study being pursued by individuals, small groups, or entire classrooms. True personalization of learning is now possible through the use of today's technology; and teachers now have at their disposal the tools that allow them to blend together the three types of knowledge described below.

Adults in most practical, work related, and problem solving situations use J-I-T Knowledge routinely and the advent of easy-to-use digital age technology has now made J-I-T Knowledge readily assessable to most school age learners. For example, a middle school student

investigating the reasons for the collapse of a large building used National Weather Bureau data to obtain the snow accumulations and temperature records for his region of the country over a 50-year period. He also obtained building code regulations and hypothesized that weight-bearing regulations written decades earlier were insufficient to accommodate present day large roof building designs. Imagine how dreadfully boring and irrelevant it would be if all students were required to learn or even memorize 50 years of weather data? The student conducting this study, however, needed the information and therefore it became instantaneously relevant.

Today's students are growing up in a world where their access to and familiarity with mobile devices provides them with instant entree to the wider world of knowledge. The Center for Applied Special Technology (1995) has gathered compelling research and evaluation findings about the influences that technology is having on achievement, higher order thinking skills, and workforce preparation, and the CEO Forum (2001) has argued that technology has had a significant impact on all areas of the curriculum. The warp-speed technological changes taking place in schools today have become one of the most pervasive occurrences having a significant impact on the education system, so much so that technology is actually influencing learning theory itself. Consequently, technology has provided the necessary impetus to reassess more traditional methods and techniques that we use to bring knowledge into the classroom and guide students in its use.

The Content and Methodology of a Discipline

Received Knowledge (Content) and Analyzed Knowledge (Process) form the basis of all disciplines and their role and interaction have been widely discussed by learning and curriculum theorists. Phenix (1964) recommends that a focus on representative concepts and ideas is the best way to capture the essence of a discipline. Representative ideas or concepts consist of themes, patterns, main features, sequences, organizing principles and structures, and the logic that defines a discipline and distinguish it from other disciplines. Representative ideas and concepts can also be used as the bases for interdisciplinary or multidisciplinary studies. When we select content, the level of advancement or complexity of material we must first and foremost take into consideration the age and ability, maturity, previous study, and experiential background of the students. Beyond these considerations, three principles of content selection are recommended. (1) Curricular material should escalate along a hierarchy of the following dimensions of knowledge: facts, conventions, trends and sequences, classifications and categories, criteria, principles and generalizations, and theories and structures. (2) Movement toward the highest level, theories and structures, should involve continuous recycling to lower levels so that facts, trends and sequences, and so on can be understood in relation to a more integrated whole rather than isolated bits of irrelevant information. (3) The cluster of diverse procedures that surround the acquisition of knowledge—that dimension of learning commonly referred to as "process" or thinking skills—should themselves be viewed as a form of content. It is these more enduring skills that form the cognitive structures and problem-solving strategies that have the greatest transfer value (Bransford et al., 2000). When we view process as content, we avoid the artificial dichotomy and the endless arguments about whether content or process should be the primary goal of learning. Combining content and process leads to a goal that is larger than the sum of the respective parts. Simply stated, this goal is the acquisition of a scheme for acquiring, managing, and producing information in an organized and systematic fashion. A focus on methodology is the most direct way to prepare young people for their roles as contributors in future fields of

professional involvement. A focus on methodology also means more than just teaching students about methods of inquiry. Rather, it is designed to promote an understanding of and appreciation for the *application* of both content and methods to the kinds of problems that are the essence of particular fields of knowledge. The goal of a focus on methodology is, therefore, to cast the young person in the role of a firsthand inquirer rather than mere learners-of-lessons, and to create a mindset that prepares young students for confrontations with knowledge that are the starting point of their own applied and created knowledge.

A Theory of Blended Knowledge

Although philosophers and epistemologists have written for centuries about the general nature of knowledge, the theory presented here is restricted to the acquisition, application, and creation of knowledge in formal (schoolhouse) learning. Thus, the main "ingredients" for developing young minds mentioned above (information, knowledge, and the creative application of knowledge) can be categorized into three general levels of knowledge depicted in Figure 1. Before describing each of these three levels it should be emphasized that while they are hierarchical in level of complexity so far as the powers of mind are concerned (c.f., Bloom's hierarchy), it is the *interaction* between and among all three levels that creates the blended knowledge which is represented in the center of the three concentric circles in Figure 1. And, as indicated above, the investigative learner returns to various levels and sources of knowledge as particular learning situations dictate. This cyclical pursuit and application of knowledge is depicted in Figure 2.

Received Knowledge

The first level of knowledge is Received Knowledge, and this is the type of material most often associated with what traditional schooling is all about. At this level, information and knowledge are frequently used synonymously; however, leading knowledge scholars define small differences (Machlup, 1980). Information captures data at a single point and refers to material that has been given some meaning by way of a relational connection (e.g., Boston and Atlanta are state capital cities). This type of knowledge is the concise and appropriate collection of information but has value only when it is made useful in situations that are relevant to the learner. It refers to a deterministic process where patterns within a given set of information are ascertained (e.g., capital cities are seats of government); what Whitehead (1929) called "inert knowledge" and described it as "...knowledge that students can exhibit when it is specifically called for (on an examination for instance), but that otherwise plays no roles in their lives" (Bereiter, p. 309).

Received Knowledge such as facts, data, vocabulary, numeracy, names, dates, and other types of information are typically conveyed to students through lectures, textbooks, worksheets, and various types of digital media. It is the type of information that is usually assessed through standardized achievement tests or "right answer" tests constructed by teachers. Received Knowledge is the foundation for all learning and thus an essential component of the blended knowledge concept that makes up the center of Figure 1. The left side of this figure represents the major inputs to the learning process and the right side represents the outputs or what we "take away" from a learning process that blends together three levels of knowledge. Although memorization, note taking skills, and recall are the main mental processes developed for the

acquisition of Received Knowledge, teachers have used attractive materials, the media, and a variety of classroom organization and management techniques to convert "raw" information into meaningful knowledge; and creative teachers have devised ways to make this level of knowledge more interesting and useful to students.

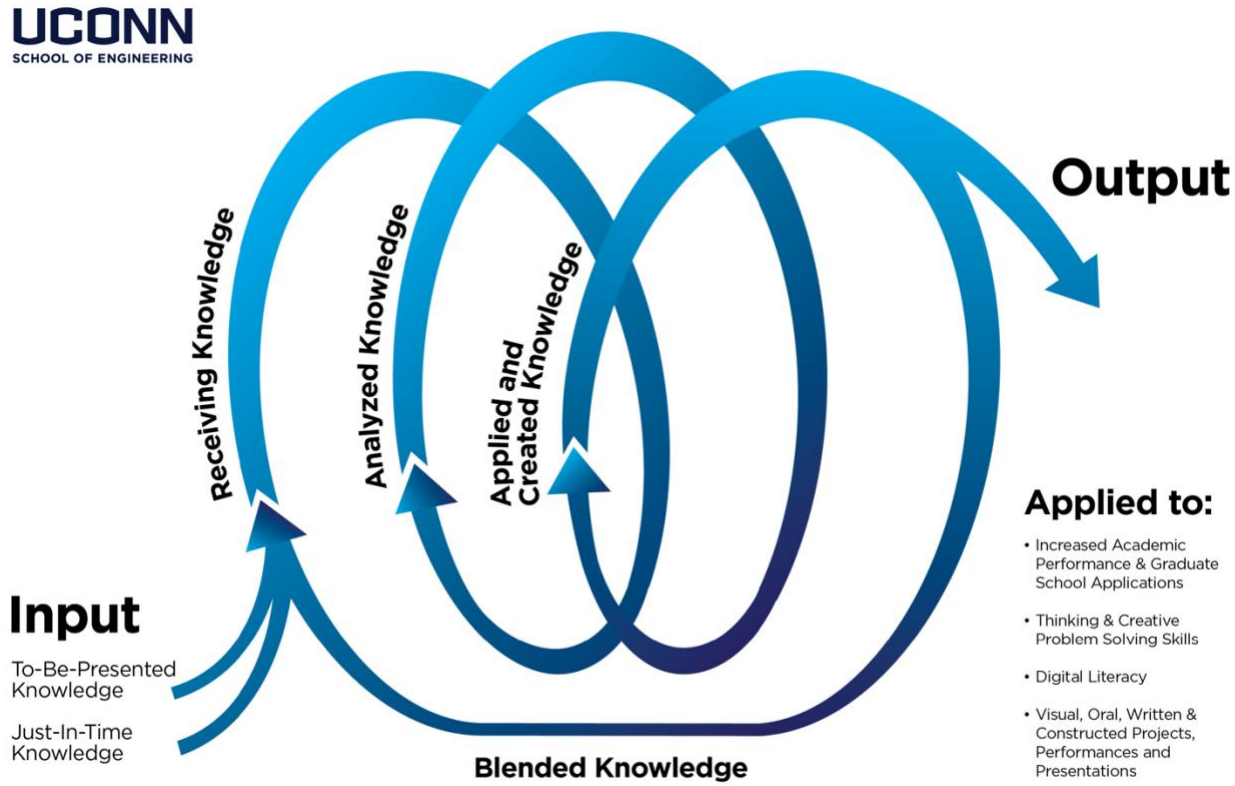

Figure 2: The cyclical pursuit of various types of knowledge.

Analyzed Knowledge

The second level of knowledge and the type that has frequently been associated with programs for the gifted is Analyzed Knowledge. This level of knowledge has grown in popularity in recent years due to the focus on 21st Century thinking skills, the process standards included in the Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), and the *Next Generation Science Standards* developed by The National Research Council, the National Science Teachers Association, and the American Association for the Advancement of Science (Next Generation Science Standards, 2013). Kaplan (2009) discussed how this level of knowledge contributes to the depth and complexity that should be a hallmark of curriculum for gifted students. Analyzed Knowledge develops thinking skills such as: interpreting, extrapolating, recognizing attributes, discriminating between same and different, comparing and contrasting, categorizing, classifying, determining criteria, ranking, prioritizing, and sequencing, seeing relationships, determining cause and effect, pattern finding, and making analogies. These skills are typically associated with Bloom's higher level thinking categories of analysis, synthesis, and evaluation (Bloom, 1954).

Classroom practices that promote Analyzed Knowledge are much more advanced than merely receiving, storing, and retrieving information. Discussions, debates, simulations, role-playing, critiquing, and questioning that focus on attitudes, values, conclusions, and why, how, and cause-and-effect are typically the ways in which analysis skills are developed. Analyzed Knowledge obviously draws upon Received Knowledge but it also interacts with Received Knowledge in a cyclical manner. When students are working at the analysis level they may find the need to acquire ("go back") and obtain additional factual information to further examine or scrutinize an argument, point of view, or interpretation of a problem they are addressing. If Received Knowledge is "grist for the mill of mind," then Analyzed Knowledge is the "relentless grinding" of information that uses Received Knowledge to develop more complex levels of thinking and understanding.

Applied and Created Knowledge

These first two levels of knowledge are both priorities for all of our students. The ability to solve problems evolves from retrieving facts, data, and information and manipulating this material in ways that create meaning for the individual and improve the powers of mind. More advanced levels of problem solving and the construction of knowledge, however, require curiosity, creativity, and the task commitment (Renzulli, 1982) to pursue problems that go beyond acquisition, prescribed problems, and even teacher assigned problem-based learning activities. These are traits that should be the focus of programs for developing giftedness and they should constitute the mission of gifted education mentioned above—increasing the world's reservoir of highly creative and productive individuals. It is this broader set of skills that develops the investigative, creative, and entrepreneurial mindsets that are exactly the characteristics that we most admire in people who have made important contributions to their respective fields of endeavor—indeed, the creative and productive people that the larger world ultimately refers to as "gifted."

The best way to promote the use of Applied and Created Knowledge is to ensure that special programs place a major focus on providing opportunities to pursue real problems in investigative and creative ways (Delcourt, 1994; Hébert, 1993; Renzulli, 1982; Westberg, 2010). Real problems differ from other types of assigned problem solving activities in four basic ways. First, students select the specific problem they want to pursue. This selection may be restricted to an assigned topic or course (e.g., Civil War in a history course), but within any general or specific topic area opportunities for personalization of interest creates internal motivation because students have choices based on their own interests. For example, within the general topic area of the Civil War, students might choose to study the music, uniforms or women's clothing fashions, fiction, photography, weaponry, human rights, the biographies of famous individuals or persons from their home towns, sea battles, the Underground Railroad, the role of women, or any other issue that holds a particular fascination for the individual or group. A series of general exploratory experiences such as a speaker or virtual field trips to Civil War sites or battlefields can be used to give students ideas about the choice of a problem in which they might develop a sustained interest (see, for example, Type I Enrichment in the *Enrichment Triad Model*, Renzulli, 1977).

Second, students are guided in procedures for formulating a hypothesis or research question and the use of authentic investigative methodology such as how practicing historians go about investigating a particular area of study. Developing a hypotheses or research question, selecting a topic for creative writing, or designing an artistic or community service project ensures that students extend beyond just "looking stuff up" and reporting it! It is at this point that teachers need to be able to assist students in tracking down How-To books and web resources that guide them in finding and focusing on investigable problems. For example, in a book entitled *Understanding History: A Primer of Historical Method*, Gottschalk (1969) writes briefly about how practicing historians choose subjects and find information about them:

> The beginner, with or without aid, can easily discover a subject that interests him or her and that will be worthy of investigation—at least at an introductory level. They need only to ask four sets of questions:
>
> (1) The first set of questions is geographical. They center around the interrogative: "Where?" What area of the world do I wish to investigate? The Far East? Brazil? My country? My city? My neighborhood?
> (2) The second set of questions is biographical. They center around the interrogative: "Who?" What persons am I interested in? The Chinese? The Greeks? My ancestors? My neighbors? A famous individual?
> (3) The third set of questions is chronological. They center around the interrogative: "When?" What period of the past do I wish to study? From the beginnings till now? The fifth century B. C.? The Middle Ages? The 1780s? Last year?
> (4) The fourth set of questions is functional or occupational. They center around the interrogative: "What?" What spheres of human interest concern me most? What kinds of human activity? Economics? Literature? Athletics? Sex? Politics? (pp. 62–63).

The third guideline for investigating a real problem is that there is no single predetermined or "correct answer" or prescribed way for conducting a study. There may be some general procedural standards that apply to research in general, but the creativity literature clearly shows us that people who have taken the road less traveled are often the ones who make innovative breakthroughs in their fields of study (Barron, Montuori, Barron, 1997; Kaufman & Sternberg, 2006; Sternberg, 1988, 2007).[1] The problems that students pursue should also be "fuzzy" ones or open-ended ones, and they should be structured in such a way that it has the potential to change actions, attitudes, or beliefs. Teacher flexibility and a willingness to entertain and respect learning style differences are important conditions at this stage for promoting creativity and the self-efficacy that Bandura (1977) argues are important contributors to independent growth. The teacher or mentor must truly serve as "the-guide-on-the-side" by giving feedback, making suggestions, recommending and helping students secure resources, and providing general support and encouragement. The skills mentioned above for facilitating Analyzed Knowledge activities can be applied here as well. In many ways, the teacher's role at this stage is similar to a college professor's role when guiding a student through a master's or

[1] John Gurdon, the 2013 winner for the Nobel Prize in medicine was criticized and given low marks by a high school teacher because: *"...he will not listen and will insist in doing his work in his own way."*

doctoral thesis. This guidance may refer back to both analysis skills and the need to carry our further searches of the Received Knowledge level described above.

The *raison d'être* of the creative/productive person in all societies is to have an impact and create change for one or more intended audiences. That is the reason why writers write, artists paint, builders build, and scientists and engineers produce new products to improve existing work and to make it more effective, efficient, and/or aesthetic. *The main goal of creative producers is to make a difference.*

The final guideline for helping students at the Applied and Creative Knowledge level is to assist young people in exploring potential outlets and audiences for their work. This exploration should begin early in the investigative and creative process because it provides motivation to complete and disseminate students' best work. An exploration of outlets and audiences allows students to become familiar with the formats and genres of the areas and disciplines in which they are working. These opportunities enable students to submit work for publication or display, both in and especially outside the school, to make presentations and performances to special interest groups, to enter their work into the almost unlimited number of special talent and academic contests and competitions that exist in practically all areas of knowledge. These highly motivating opportunities to publish, present, and perform create real world experiences to teach students about self-regulation, time management, meeting deadlines, and other executive function skills. One need only examine the legendary success of programs such as Future and Community Problem Solving, National History Day Competition, International Science and Engineering Fair, Invention Convention, and a host of other competitions to understand the role that outlets and audiences play in the creative and productive process.

Summary

This Theory of Blended Knowledge has the most critical relevance for what and how we teach high potential young people, as it focuses on opportunities for creative productivity within standard curriculum practices, and on how we train teachers of gifted and highly creative students. If one of the goals of gifted education is to increase the world's reservoir of highly creative and productive individuals, we must devote as much attention to Analyzed and Applied and Created Knowledge as we do to requiring students to simply acquire larger and larger amounts of information. One student described her Advanced Placement courses as "...test-prep on steroids," and said that she learned more about creativity, joyful learning, and "thinking hard" through working on the school yearbook, participating in the debating club, and preparing for a National History Day competition. *Using and blending* knowledge, both T-B-P and J-I-T, create a different brand of learning, and this brand should be the focus of work with high potential young people.

This theory simply portrays the ways that different kinds of knowledge interact with one another to produce "blended knowledge" as depicted at the center of Figure 1. Learners receive information, but when they begin to analyze this information they may find a need to "go back" and gather additional material for a more advanced analysis. Similarly, when they reach the applied and creative stage, it is often necessary for them to return to the received and applied levels; and "return trips" to these levels are usually based on just-in-time rather than presented information. And in cases when new knowledge, innovative contributions to a field, or even new

ways of analyzing data (e.g., Big-C contributions such as Rubin's Causal Model in statistics) are made at the applied and creative level, the innovative person will then have added content that will become part of received knowledge in other learning venues. Although this process is a natural way that learning takes place, an overly standardized test-prep curriculum that severely emphasizes received knowledge can and will "discriminate" against both the analyzed and applied/creative levels of learning. Although this theory ideally can be applied to learning situations for all students, the inclusion of the applied and creative level of knowledge is most associated with the goals that should be allied with programs for gifted and talented students. It is for this reason that the theory presented here has special relevance to the pedagogy advocated in talent development programs. The ways in which we develop curriculum, instructional techniques, and train teachers to work with gifted students strives to build an identity that is qualitatively different from general educational theories.

Like any other conceptual formulation, this theory is designed, first and foremost, to generate research testable hypotheses. Are accelerated courses that only provide advanced coverage of received knowledge producing desired results? Does adding analyzed knowledge result in different outcomes? What happens when we add all three levels to produce truly blended knowledge? These questions strike at the heart of the age-old dichotomy in our field between acceleration and enrichment. The Theory of Blended Knowledge described in this article can and should be tested, as it asserts that *both* acceleration and enrichment should be important components of gifted and talented programs.

The right hand side of Figure 1 represents the outputs of a blended knowledge approach to learning and creative productivity. Increased academic achievement in the traditional sense is mentioned first because, whether we like it or not, any theory that does not include advanced content and the benefits of acceleration is logically flawed and will be rejected out of hand by policy makers and administrators. But a focus on 21st Century skills has caused some reform-minded policy makers to embrace the importance of including Analyzed Knowledge in the goals of general education. It may also be reasonable to assume that these persons will see the value of considering the importance of blending all three levels of knowledge discussed here to further enhance creative productivity in our high potential students. Finally, it may even be reasonable to hope that they may see some logic in giving students at all levels opportunities to engage in some of the activities that promote Applied and Created Knowledge as well as Received and Analyzed Knowledge. The enjoyment, engagement, and enthusiasm for learning that results from blending all three levels of knowledge in the learning process could reduce the achievement gap and reduce the boredom factor that continues to plague so many students in our schools, especially in schools serving low income students. This challenge may be one of the first research questions that this theory could promote. A blended knowledge theory is particularly relevant to our highest achieving students (regardless of income level) because it represents the *modus operandi* of gifted contributors in the larger world of knowledge construction, usage, and dissemination.

The Theory of Blended Knowledge draws upon the wisdom of intellectual founders in the field of epistemology, it takes into account the over-standardization of formal schooling that has taken place over the past several decades, and it recognizes the dramatic changes in learning that are now possible through the use of technology. The theory also has special relevance to gifted education because knowledge creation, utilization, and diffusion are what creative and productive people do. The type of learning advocated by this theory is the way that the pursuit of

knowledge naturally occurs in "real world" places. Scientists in research laboratories, writers working on a book or play, and social scientists gathering data to analyze various human behaviors do exactly what this theory specifies. If we want our most able young people to think, feel, and do like practicing professionals, we must include in their overall school experiences these kinds of opportunities to pursue and act on existing knowledge as it is done outside of formal schooling. Although learning in this "natural way" should occur for all students and at all grade levels, mass education and the text book/testing industrial complex have kidnapped the process by over-prescription, a test-prep driven curriculum, and a linear/sequential interpretation of learning hierarchies.

The current focus on deductive, didactic, and prescriptive approaches to "canned curriculum" has resulted in limited opportunities for inductive, investigative, and inquiry approaches to learning. This emphasis has been especially detrimental to our most able students by turning them into efficient lesson learners and consumers of knowledge, but limiting their opportunities for developing high levels of creative productivity and an *investigative learning* mindset. The young people who have the potential to make significant contributions to the arts, sciences, and all other areas that result in economic, social, and culture growth cannot change the world if educators do not integrate applied and created knowledge with advanced content. Like any other theory, I hope this Blended Knowledge Theory will generate research on the parts of interested scholars, and will serve a practical purpose of causing us to reexamine our mission, goals, practices, and especially the ways in which we train teachers who will work with gifted students. An important part of the research that this theory might generate should focus on longitudinal studies of highly creative and productive adults whose work has made a difference in their chosen fields of endeavor and even changed the world. If we want special programs and services for high potential young people to gain the recognition and support we advocate, the best "data" we can put forward is testimony that demonstrates their gifted programs made a difference beyond merely enabling them to earn good grades, high test scores, and advanced degrees. It must demonstrate that these programs have, indeed, contributed to expanding the reservoir of the world's highly creative and productive individuals.

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