The Integrated Curriculum Model (ICM)

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ABSTRACT

This article explicates the Integrated Curriculum Model (ICM) which has been used worldwide to design differentiated curriculum, instruction, and assessment units of study for gifted learners. The article includes a literature review of appropriate curriculum features for the gifted, other extant curriculum models, the theoretical basis for the ICM model, a description of the model, research that has been conducted to date on its effectiveness, and specific implications for use in classroom settings in schools.

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As gifted education becomes more concerned about appropriate programs and services that can bolster achievement in schools for both gifted and other populations and less concerned about precise identification of who is gifted, the emphasis turns then to what works—what programs and services are likely to produce the greatest learning for students? It is in this context that the following article has been crafted, outlining one curriculum model that has empirical evidence to suggest that students exposed to the units of study crafted on the model show significant and important gains in learning at the higher levels of thought within specific subject areas. The model is also explanatory in respect to the use of accelerative and enrichment approaches, suggesting that both are warranted and desirable if used in an integrative way.

1. Overview of the model

The Integrated Curriculum Model (ICM) is a comprehensive and cohesive curricular framework which employs good curricular design, considers the features of the disciplines under study, and is differentiated for gifted learners. Salient characteristics of the gifted learner including precocity, intensity, and complexity are addressed simultaneously in this integrated curriculum approach, addressing both cognitive and affective dimensions of the gifted learner.

As more gifted students are being served in heterogeneous or self-contained settings, integrated curriculum approaches can work better than partial interventions, providing needed differentiation within traditional areas of learning for which schools are accountable (VanTassel-Baska, 2003a,b). This integrated approach also reflects recent research on learning. Studies have documented that better transfer of learning occurs when higher-order thinking skills are embedded in subject matter (Minstrell & Krause, 2005; NRC, 2000; Perkins & Saloman, 1989) and teaching concepts in a discipline is a better way to produce long-term learning than teaching facts and rules (Marzano, 1992). Our understanding of creativity also has shifted toward the need for strong subject matter knowledge as a prerequisite (Amabile, 1996).

The ICM was first proposed in 1986 and further expounded upon in subsequent publications (VanTassel-Baska, 1986, 1992, 1994, 1998, 2003b). The model is comprised of three interrelated dimensions that are responsive to different aspects of the gifted learner which can be thought of as the following (adapted from VanTassel-Baska, 2003b, p. 7–8):

1. *Emphasizing advanced content knowledge that frames disciplines of study.* Honoring the talent search concept, this facet of the model ensures that careful diagnostic-prescriptive approaches are employed to enhance the challenge level of the curriculum base. Curricula based on the model would represent advanced learning in any given discipline.
2. *Providing higher-order thinking and processing.* This facet of the model promotes student opportunities for manipulating information at complex levels by employing generic thinking models like Paul's Elements of Reasoning (1992) and more discipline-specific models like Sher's Nature of the Scientific Process (1993). This facet of the ICM also promotes the utilization of information in generative ways, through project work and/or fruitful discussions.

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3. *Organizing learning experiences around major issues, themes, and ideas that define understanding of a discipline and provide connections across disciplines.* This facet of the ICM scaffolds curricula for gifted learners around the important aspects of a discipline and emphasizes these aspects in a systemic way (Ward, 1981). Thus, themes and ideas are selected based on careful research of the primary area of study to determine the most worthy and important ideas for curriculum development, a theme consistent with reform curriculum specifications in key areas (American Association for the Advancement of Science, 1990; Perkins, 1992). The goal of such an approach is to ensure deep understanding of disciplines, rather than misconceptions.

The ICM model synthesizes the three best approaches to curriculum development and implementation documented in the literature for talented learners (Benbow & Stanley, 1983; Maker, 1982; Ward, 1981). Recent reviews of curricular interventions for the gifted have found the greatest effectiveness prevailing in an accelerative approach, guided by the content modification features exemplified in the ICM (Johnsen, 2000; VanTassel-Baska & Brown, 2000). The fusion of these approaches is central to the development for a coherent curriculum that is responsive to diverse needs of talented students while also providing rich challenges to all for optimal learning.

2. Theoretical underpinnings

The theoretical support for the Integrated Curriculum Model comes primarily from two sources. One source is the work of Vygotsky (1978) in three aspects of his theoretical orientation. One aspect critical to the model is the zone of proximal development where learners must be exposed to material slightly above their tested level in order to feel challenged by the learning experience. This idea was expanded on by Csikszentmihalyi (1991) in his concept of flow where gifted learners demonstrated a broader and deeper capacity to engage learning than did typical students (Csikszentmihalyi, Rathunde, & Whalen, 1993).

A second aspect of the Vygotsky (1978) theory of learning influential to the model is his view of interactionism, whereby the learner increases learning depth by interacting with others in the environment to enhance understanding of concepts and ideas. Ideas are validated and understood through the articulation of tentative connections made based on a stimulus such as a literary artifact, a film, a piece of music, or a problem. Learning increases as interactions provide the scaffolding necessary to structure thinking about the stimulus (Vygotsky, 1978).

A third aspect of Vygotsky's (1978) theory applicable to the development of the ICM was his theory of constructivism whereby learners constructed knowledge for themselves. This theory is central to the tenets of the teaching and learning models found in the ICM curriculum and a central thesis to the model itself as students must be in charge of their own learning in respect to each dimension of the model, whether it be content acceleration, project-based learning opportunities such as PBL, or discussion-laden experiences in which concepts, issues, and themes are explored.

Another theoretical influence on the model was the work of Mortimer Adler and his Paedaeia Proposal (1984) that posited the importance of rich content representing the best products of world civilization coupled with the relevant cognitive skills to study them, appropriately linked to the intellectual ideas that spawned the work of the disciplines and philosophy. His world view of curriculum was highly influential in thinking about the role of academic rationalism in a curriculum for the gifted, even as cognitive science was the predominant force in the larger environment.

Finally, the theory of multiculturalism espoused by James Banks (1994a,b, 2001) and more recently by Donna Ford (2005, Ford & Harris, 1999) speaks to the aspect of the ICM concerned with students making a better world through deliberate social action, whether through the resolutions brought to policy makers as a result of PBL work or the studies of technology use in researching issues or the concerns for censorship in the history of great literature. Moreover, this theoretical orientation also provided a major emphasis on the works of minority authors both in this country and abroad as well as an attempt to acknowledge multiple perspectives in student understanding of any content area, especially history.

3. Description of the ICM model

Research into appropriate curriculum for the gifted child is rather meager. Until the *Sputnik* era of the late 1950s, which resulted in programs that addressed specific content areas, few ideas about differentiated curriculum for the gifted were systematically studied. Even though special classes had been in operation since 1919 in selected locations, usually large cities, the actual differences in instructional strategies, content, or materials were not examined. Grouping based on intelligence and achievement was the predominant strategy employed, although individual grade acceleration was practiced to some extent, and curriculum outlines and sometimes units were prepared for use with the identified gifted students (Hall, 1956; Hollingworth, 1926).

Over the past 40 years, however, educators in the field of the gifted have chronicled several key ideas about what constitutes appropriate curriculum for gifted children. The progenitor for these ideas was Ward (1961, 1981) who developed a theory of differential education for the gifted that established specific principles about curriculum for the gifted, distinctive from what should be done with all learners. Meeker (1969) used the Guilford Structure of Intellect (SOI) model to arrive at student profiles that highlighted areas of strength and weakness so that curriculum planners could build a gifted program to improve weak areas. Based on a multi-dimensional view of giftedness and a special education orientation to individualization, curriculum workbooks were structured to address this need in the areas of memory, cognition, convergent thinking, divergent thinking, and evaluation. Renzulli (1977) focused on a model that moved the gifted child from enrichment exposure activities through training in thinking and research skills into a project-oriented program that dwelt on real problems to be solved. Gallagher (1985) stressed content modification in the core subject areas of language arts, social studies, mathematics, and science. Stanley, Keating, and Fox (1974) concentrated on a content acceleration approach to differentiate programs for the gifted. Feldhusen and Kolloff (1978), Kaplan (1979), and Maker (1982) have stressed a confluent approach to differentiation of curriculum for the gifted that includes both acceleration and enrichment strategies. Passow and colleagues (1982) formulated several cardinal curriculum principles that reflect content, process, product, behavioral, and evaluative considerations. VanTassel-Baska (1988, 1992, 1998, 2003a,b) earlier synthesized research-based approaches to gifted curriculum and translated them into each content area, using traditional curriculum design and alignment to standards as major techniques for curriculum development. Sternberg (2000) has applied his componential theory of giftedness to curriculum and instructional design, creating curriculum that addresses analytic, synthetic, and practical abilities of learners, reminiscent of the aptitude treatment interaction studies of the 1970's. Tomlinson, Kaplan, Purcell, Renzulli, Leppien, and Burns (2002) envisioned curriculum for the gifted as a set of parallel approaches that include emphasis on core knowledge and skills, generative learning, identity development, and interdisciplinary opportunities.

Current work in the ICM model for the gifted has continued to focus on a merger with the curriculum reform principles advocating world-class standards in all traditional curricular areas (VanTassel-Baska & Little, 2003). The major shift in thinking regarding this orientation is from one that looks only at the optimal match between characteristics

of the learner and the curriculum to a model based on performance in various domains, thereby letting the level of functioning determine who is ready for more advanced work in an area rather than a predictive measure. Thus, differentiation for any population is grounded in differential standards of performance at a given period of time. Standards are constant; time is the variable. Such an approach holds promise for gifted students in that the level and pace of curriculum *can* be adapted to their needs, and the existing state standards call for the kind of focus that curriculum makers for gifted students have long advocated—higher-level thinking, interdisciplinary approaches, and an emphasis on student-centered learning.

Gifted students need high but realizable expectations for learning at each stage of development. Other students can benefit also from working to attain such standards. By the same token, gifted students can also benefit from a developmental and personal perspective on fostering their abilities at a close-up level, an emphasis requiring organizational models such as tutorials, mentorships, and small clusters to support it.

Although research on curriculum for the gifted provides limited evidence regarding effectiveness, three relatively distinct curriculum dimensions have proven successful with gifted populations at various stages of development and in various domain-specific areas. They are (1) the content mastery dimension, (2) the process/product research dimension, and (3) the epistemological concept dimension. Taken together, these research-based approaches have been synthesized to form the Integrated Curriculum Model (VanTassel-Baska, 1986, 1998; VanTassel-Baska & Little, 2003; VanTassel-Baska & Stambaugh, 2006). Fig. 1 portrays these interrelated dimensions of the ICM model.

3.1. Content

The content mastery dimension emphasizes the importance of learning skills and concepts within a predetermined domain of inquiry. Gifted students are assessed on their level of proficiency in a content area, and encouraged to move through basic material of a content area at a faster rate; thus, content acceleration dominates the application of this dimension of the ICM and is effected by the use of preassessments in core areas of learning and the employment of advanced content material.

3.1.1. Content acceleration

Although the field of gifted education is not prolific with intervention studies, the body of literature on acceleration in general places it in the category of the most effective approach that can be employed with many gifted learners (Colangelo, Assouline, & Gross, 2004). Reviews of the literature on acceleration have appeared with some regularity over the last 40 years indicating that more has been written about the efficacy of accelerative practices with the gifted

than about any other single educational intervention with any population (Benbow, 1991; Daurio, 1979; Gallagher, 1969; Kulik & Kulik, 1984; Reynolds, Birch, & Tuseth, 1962).

A broad-based research agenda dedicated to understanding the long-term effects of educational acceleration of the gifted has emerged in the field of gifted education (Brody, Assouline, & Stanley, 1990; Brody & Benbow, 1987; Brody & Stanley, 1991; Colangelo et al., 2004; Shea, Lubinski, & Benbow, 2001). Each review has carefully noted the overall positive impact of acceleration on gifted individuals at various stages in the life span. Meta-analyses (Rogers, 1992; Rogers & Kimpston, 1992) indicate that acceleration methods (compacting, telescoping etc.) result in positive academic gains, and that, while more research is needed, the misconceptions that early entrance and grade skipping result in negative social/emotional consequences are tenuous. Successful programs of acceleration, most notably offshoots of the basic talent search model developed by Stanley and others in the 1970s, have demonstrated significant positive impact on the learning of students (Benbow & Stanley, 1983; Kulik & Kulik, 1992; Swiatek & Benbow, 1991a,b).

Findings of multiple studies from Study of Mathematically Precocious Youth (SMPY) have consistently focused on the benefits of acceleration for continued advanced work in an area by precocious students (Stanley et al., 1974), a clear rationale for the use of acceleration in intellectual development (Keating, 1976), and the long-term positive repeated impacts of accelerative opportunities (Benbow & Arjmand, 1990). Longitudinal data, collected over the past 20 years on 2188 highly gifted talent search students, have demonstrated the viability of the Stanley model in respect to the benefits of accelerative study, early identification of a strong talent area, and the need for assistance in educational decision-making (Lubinski & Benbow, 1994). The data also suggest continued patterns of high achievement and life satisfaction in adulthood for accelerants over comparison groups. A recent review of longitudinal studies on acceleration continues to demonstrate the positive results of accelerative practices and the lack of negative consequences such as knowledge gaps or loss of interest (Swiatek, 2002).

Studies focusing on acceleration continue to reflect positive results in cognitive development from acceleration and no negative effects on social emotional development. Brody and Benbow (1987) reported no harmful effects of various forms of acceleration, including grade skipping and advanced course-taking, among SMPY students subsequent to high school graduation. Accelerated students generally earned more overall honors and attended more prestigious colleges. Richardson and Benbow (1990) and Swiatek and Benbow (1991b; Swiatek, 2002) subsequently reported no harmful effects of acceleration on social and emotional development or academic achievement after college graduation. Concerns about these students "burning out" through difficult coursework were not founded (Swiatek, 2002). Janos et al. (1988) reported no detrimental effects of acceleration on young entrants to college. In another study, Robinson and Janos (1986) found similar adjustment patterns for early entrants in comparison to three equally able nonaccelerated comparison groups, noting only unconventionality as a distinguishing characteristic of the early entrants. A study of female-only early college entrants, positive personality growth was found during the first year of acceleration in the program (Cornell, Callahan, & Loyd, 1991).

3.1.2. Diagnostic-prescriptive instructional approach

The content dimension in the ICM model emphasizes the importance of learning skills and concepts within a predetermined domain of inquiry using a deliberate instructional approach. When a diagnostic-prescriptive instructional approach (D→P) is utilized, students are pretested and then given appropriate materials to master compressed subject area segments as prescribed, based on tested level.

The D→P instructional approach has proved effective in controlled settings but has not been widely practiced in regular classrooms for
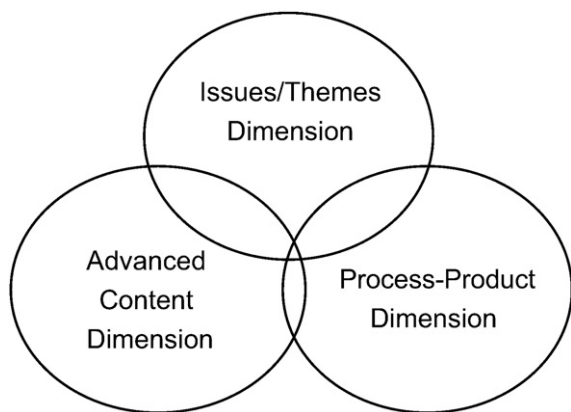

Fig. 1. Dimensions of the ICM model.

the gifted. The D→P approach to the content model has been utilized effectively by talent search programs across the world, particularly in mathematics (Benbow & Stanley, 1983; Keating, 1976). VanTassel-Baska (1982) has shown the effectiveness of the model in teaching Latin, and foreign language teachers have used the model for years to ensure English syntactic mastery in their students. Students participating in a 3-week residential summer program were able to master a year's worth of one year of high school science use of the D→P approach, and follow-up studies suggested that they performed well in science courses offered at their traditional schools (Lynch, 1992).

Recent research undertaken at Northwestern University's Center for Talent Development indicates that middle and early high school students completing "Advanced Placement" or honors level high school courses through advanced and accelerated instruction using D→P perform as well or better on end-of-year standardized tests as older students who take the same course for a full year (Olzewski-Kublius, 2005). Students involved in the Study of Exceptional Talent (SET) who took advantage of "Advanced Placement," International Baccalaureate and/or distance learning reported having meaningful school friendships, participated in extracurricular and summer experiences and took part in challenging international and national competitions during their high school experience (Muratori, 2004 in Brody, 2005).

3.1.3. Curriculum compacting

Reis and Renzulli (2006 ¶ 3; Reis, 1995) defined curriculum compacting as an instructional technique "that is specifically designed to make appropriate curricular adjustments for students in any curricular area and at any grade level". Compacting typically has been applied to small segments of curriculum such as a chapter in math. It entails the following three steps: 1). the definition of goals and outcomes of a particular unit or segment of instruction (Reis & Renzulli, 2006, ¶ 3), 2). ascertaining which students have already mastered most or all of a specified set of learning outcomes (Reis & Renzulli, 2006, ¶ 3), and 3). providing replacement strategies for the material already mastered by utilizing instructional options that enable a more challenging and productive use of the student's time (Reis & Renzulli, 2006, ¶ 3).

Research into the effects of teacher training in the implementation in this technique indicate that after receiving training in curriculum compacting, teachers were able to eliminate between 42% and 54% and sometimes as high as 70% of the content for the high-ability students they selected, and the majority were enthusiastic about the process of modifying curriculum for their students (Reis & Westberg, 1994; Reis et al., 1992a,b) although some teachers needed additional support in designing stimulating and rigorous replacement activities (Reis & Purcell, 1993). Additional studies indicate that teachers trained in compacting noticed differences in their classroom practices and had a desire to implement the process (Stamps, 2004).

Several studies have been conducted regarding student achievement and performance as a result of compacting the curriculum. Curriculum compacting and telescoping were found to have positive academic outcomes for students in math (Reis et al., 1992a,b; Rogers, 1992; Rogers & Kimpston, 1992). Reis, Westberg, Kulikowich, and Purcell (1998) found that students' achievement scores increased as a result of compacting, demonstrating that students do not fall behind in areas where their work has been compacted, even though they are usually working on other material.

An evaluation conducted on the Advanced Placement (AP) program from the point of view of intellectually precocious youth and their subsequent educational–vocational outcomes, found that students who took AP courses, compared with their intellectual peers who did not, appeared more satisfied with the intellectual caliber of their high school experience and, ultimately, achieved more (Bleske-Rechek, Lubinski, & Benbow, 2004).

The content dimension of the ICM model stresses the use of advanced content implemented through a diagnostic-prescriptive approach that preassesses learning for each student and prescribes instruction appropriately based on that knowledge.

4. The process/product dimension

The process/product dimension places heavy emphasis on learning investigatory skills, both scientific and social, that allow students to develop a high-quality product. It is a highly collaborative approach that involves teacher–practitioner–student as an interactive team in exploring specific topics. Consultation and independent work dominate the instructional pattern, culminating in student understanding of various discipline-specific processes as they are reflected in selective exploration of key topics (VanTassel-Baska & Stambaugh, 2006).

4.1. Critical thinking skills and cognitive processes

Studies of thinking contribute to understanding this dimension of curriculum for the gifted. Much ongoing research is attempting to explain how children master complex knowledge structures and procedures (Bereiter, 2002). In both reading and mathematics, current research has supported a meaning-based approach that provides appropriate practice in key activities (Grouws & Cebulla, 2000; Korkeamaki & Dreher, 1996). Expert–novice comparisons in various fields (Anderson & Leinhardt, 2002; Villachica et al., 2001) have yielded differences favoring experts in metacognitive acts like planning and revising. A collection of research on expertise has revealed that the successful utilization of these skills may be content-specific. Ericsson (1996) found that expert performance entailed a large knowledge base of domain-specific patterns, rapid recognition of situations in which these patterns apply, and the use of forward reasoning based on pattern manipulation to reach solutions (cited in VanTassel-Baska & Stambaugh, 2006).

There is also much research that suggests that "thinking at its most effective [level] depends on specific context-bound skills and units of knowledge that have little application to other domains" (Perkins & Saloman, 1989, p. 119) and that the most useful strategies are context-dependent (Pressley & Woloshyn, 1995). However, there is also a growing research base focused on increasing the transfer of knowledge from one domain to another (Haskell, 2001), including the use of metacognitive strategies to aid in transfer (Dean & Kuhn, 2003). Indeed, the existence of the construct of g, a general factor of intelligence, presupposes the existence of some domain-general skills. Some researchers in cognition and evolutionary psychology have posited that g is directly related to a decontextualized meta-representational ability (MacDonald & Geary, 2000). Even this view, though, acknowledges the important role that deep understanding of a content area plays in the ability to transfer learning; Haskell (2001) uses this idea in four of his eleven prerequisites for transfer.

Many pull-out programs for the gifted, which reflect this orientation, have emphasized critical thinking, creative thinking, and problem solving as the substance of their curricula, treating these process skills as content dimensions in their own right (VanTassel-Baska & Stambaugh, 2006). Research supports this orientation if there is also an emphasis on deep content knowledge and applying cognitive skills directly to this content (Haskell, 2001). Research in the area of critical thinking, higher-level processes and metacognition is diverse and includes studies from talent search programs, school and college programs and curricula, and grouping.

Studies stemming from the Schoolwide Enrichment Model (SEM) have investigated the impacts of various enrichment experiences such as Type II (promotion of thinking, feeling, research, communication, and methodological processes) and Type III, (in which the learner assumes the role of a first-hand inquirer: thinking, feeling, and acting like a practicing professional, with involvement pursued at a level as

advanced or professional as possible, given the student's level of development and age). Studies from SEM indicate the following: 1). students who were introduced to Type II training were more likely to initiate investigative projects (Burns, 1988); 2.) students participating in lessons which focused on creativity, planning, decision-making, forecasting and communicating coupled with a Type III investigation produced completed products and with higher quality (Newman, 2005); 3). students with twice exceptionalities who were exposed to an Type III intervention demonstrated positive behavioral gains; and 4). students engaged with Type III investigations showed more positive changes in personal skills, characteristics, and decisions relating to career choices and post-secondary educational plans (Delcourt, 1993, 1994; Hebert, 1993).

With regard to district school programs, several studies have been conducted. First, Gallagher & Stepien (1996) found that children from culturally diverse and/or low socioeconomic backgrounds made significant gains in their reasoning abilities as an outcome of participating in a program focusing on enriching thinking, creativity, and problem-solving skills. Similar findings have been found for the use of Bloom's Taxonomy (Weller, 1982). Schack (1993) found that gifted, honors and average students benefited from creative problem-solving instruction by demonstrating higher gains in problem-solving ability levels over students who did not receive the instruction. Students exposed to sessions on metacognitive awareness demonstrated an awareness of their mind's ability, complexity of thinking, and understanding of differences in thinking as well as an appreciation for differences in the problem-solving process (Sheppard & Kanevsky, 1999).

In response to the challenge in higher education settings to prepare students who are able to meet the demands of a global community, King (1989, 1991, 1994) developed the Guided Reciprocal Peer Questioning for instructors to provide students with question stems based on the levels of Bloom's taxonomy. Studies have indicated that this instructional method was found to increase student higher-level thinking and learning as well as student growth in autonomy and self-esteem (French, 2006). The *Philosophy for Children Program* developed by Lipman (1988, 1996, 2003), which is based on the presuppositions of children's ability in abstraction, higher-order cognitive skills, experience, and the synthesis of knowledge across disciplines utilizes novels which stimulate questioning and discussion for students elementary through high school and has demonstrated critical thinking gains for students using the program (French, 2006). Data support degrees of effectiveness of the curriculum in critical thinking, deductive reasoning, and/or higher-level thinking of students and support for the curriculum as an effective way of enhancing students' reading comprehension and math skills, emotional intelligence and general cognitive ability (Institute for the Advancement of Philosophy for Children, 2004; Nagi, 2003).

One manifestation of this curriculum dimension engages the student in problem finding and problem solving and puts the student in contact with adult practitioners. In the field of science, for example, scientists from national science laboratories work with academically talented junior high students during the summer to help them develop research proposals for project work during the following academic year (VanTassel-Baska & Stambaugh, 2006). Students are actively involved in generating a research topic, conducting a literature search, selecting an experimental design, and describing their plan of work in a proposal. The proposal is then critiqued not only by the instructor but also the scientist. In this way, then, students focus on process skill development in scientific inquiry and strive to develop a high-quality product (VanTassel-Baska & Stambaugh, 2006).

Another manifestation of the dimension emphasizes problem-based learning (PBL) — an approach that allows the student to generate learning tasks based on a paradigm of the known, the need to know, and the process by which needed knowledge can be acquired (Roh, 2003;

Sonmez & Lee, 2003; VanTassel-Baska, Bass, Ries, Poland & Avery, 1998). PBL was first used in the medical profession to better socialize doctors to patient real-world concerns. Research conducted by Patel and Kauffman (2001; cited in Sher, 2003) in the medical field yielded significant differences in the clinical reasoning skills of PBL and traditionally trained students, with traditionally trained students being more likely to display an expert style of clinical reasoning than students from PBL-trained programs.

PBL is now selectively employed in educational settings at elementary and secondary levels with gifted learners (Boyce, VanTassel-Baska, Burruss, Sher, & Johnson, 1997; Gallagher & Stepien, 1996). Gifted students enrolled in the Illinois Math and Science Academy (IMSA), a residential high school for gifted learners, were exposed to problem-based science and social studies courses. Studies indicated that those students exposed to social studies courses not only acquired the content they would have acquired in a traditional course, but performed better on fact finding, problem finding, and solution finding (Gallagher & Stepien, 1996; Gallagher, Stepien, & Rosenthal, 1992; Stepien, Gallagher, & Workman, 1993; cited in Sher, 2003). Students in a PBL-based biochemistry course acquired in-depth understanding of concepts, although content coverage was promoted by lecture, rather than by PBL (Dods, 1997; cited in Sher, 2003). Research in this area indicates that students participating in problem-based learning do not sacrifice content knowledge and acquisition when compared with students who are not exposed to this type of learning (Gallagher & Stepien, 1996) and that problem-based instruction enhances the use of problem-solving steps (Gallagher et al., 1992; Stepien et al., 1993) and that it helps students increase their understanding of scientific research design process (VanTassel-Baska et al., 1998).

This curriculum and instructional dimension of the ICM model most closely parallels the recommendations of national curriculum groups in both science and mathematics who tend to favor a student-directed, hands-on, inquiry-based process of problem solving, where students are engaged in the act of constructing knowledge for themselves. It is also in line with the National Research Council (2000) recommendations for using cognitive learning strategies (Minstrell & Krause, 2005; NRC, 2000). The ICM model actively employs these higher-level processes and student products as key aspects of student learning experiences.

5. Epistemological concept dimension

The epistemological concept dimension focuses on gifted students' understanding and appreciating systems of knowledge rather than the individual elements of those systems. The concept-based model is organized by ideas and themes, not subject matter or process skills. It is highly interactive in its instructional context, which contrasts with the more independent modes of instruction used in the other two models. It reflects a concern for exposing students to key ideas, themes, and principles within and across domains of knowledge so that schemata are internalized and amplified by further examples (VanTassel-Baska & Stambaugh, 2006). Concern for the nature and structure of knowledge itself is a major underlying tenet.

As students focus their energies on reading, reflecting, and writing, the teacher questions, raising interpretive issues for discussion and debate. Aesthetic appreciation of powerful ideas in various representational forms is viewed as an important outcome (VanTassel-Baska & Stambaugh, 2006). The evaluation of students engaged in this model typically requires evidence of high-level aesthetic perceptions and insight rather than content proficiency. Culminating products tend to be well-crafted essays or artistic forms that show evidence of synthesizing forms and meaning across areas of study (Eisner, 2005). Teacher training in interdisciplinary learning strategies has resulted in an increase in teacher perceptions of the knowledge and skills necessary to employ this approach in classrooms (Hollingsworth, Johnson, & Smith, 1998).

Many writers in the field of gifted education have lauded the epistemological approach to curriculum (Hayes-Jacob, 1981; Maker, 1982; Tannenbaum, 1983; Ward, 1961, 1981). Some extant curriculum has been organized around the model at both elementary and secondary levels. The College Board Advanced Placement Program relies heavily on this curriculum approach in its history (both American and European) and literature and composition programs. The Junior Great Books program, Philosophy for Children, and Man: A Course of Study (MACOS) are elementary programs that also promote the approach. Each of these programs stresses the use of Socratic questions to stimulate an intellectual discussion among students on an issue or theme. Creating analogies across a field of inquiry is encouraged, and interdisciplinary thinking is highly valued. Specific curriculum development efforts for the gifted have also used an epistemological framework by employing large interdisciplinary concepts (Center for Gifted Education, 1992; Gallagher, 1982; VanTassel-Baska & Feldhusen, 1981), and larger curriculum projects in the past—such as CEMREL's mathematics program at the secondary level and the Unified Mathematics program at the middle school level—have utilized a thematic approach to the organization of content.

The dimension of concept learning in the ICM stresses the importance of using a core concept as an organizer within subject areas and as connectors to interdisciplinary learning. This core concept approach is then integrated throughout the curricular units of study through task demands, questions and assessments.

Effective curriculum and instruction for the gifted has reached a stage of evolution where existing theoretical and research-based models need to be systematically translated into practice at the local level. Competition among these models has dissipated the effect of building a strong differentiated program for the gifted that addresses all of their intellectual needs within the core curriculum as well as at all levels outside it (VanTassel-Baska & Stambaugh, 2006). The ICM synthesis of the content, process/product, and concept dimensions of differentiated curriculum for the gifted have provided a clear direction for curriculum development as demonstrated by the products developed through the Javits program at the Center for Gifted Education at The College of William & Mary in language arts, science, mathematics and social studies that are used in classrooms as core curriculum for both gifted and promising learners (VanTassel-Baska & Stambaugh, 2006).

6. Research on the effectiveness of the Integrated Curriculum Model

Studies have been conducted over the past decade to discern the learning gains of gifted learners, promising learners from low-income and minority backgrounds, and typical learners. Both quasi-experimental and experimental designs have been employed to demonstrate differences among ability-similar groups of learners using curriculum based on the model compared to those who have not been exposed to such curriculum. An overview of these studies and their results in language arts, science and social studies follow.

6.1. Research design and central findings from language arts effectiveness studies

The William and Mary language arts curriculum for high-ability learners in grades 3–8, based on the ICM model, has been rigorously evaluated with demonstrated effectiveness and acceptance by teachers. Over the last six years, specific units were evaluated by the National Association for Gifted Children curriculum division and described as "exemplary," resulting in a designated award. Not only have the units undergone four major revisions, the next-to-last edition of the units was field-tested across multiple school districts.

The programmatic goals across all units have consistently been to (a) develop student understanding of the concept of change, (b) develop literary analysis and interpretation, persuasive writing skills, and linguistic competency skills, and (c) promote the reasoning

process. Specific learning outcomes have been aligned with the intent of the *National Council of Teachers of English* and the *International Reading Association* standards that advocate for substantive content, high-level thinking processes, and mastery of meaningful language arts skills. However, the studies conducted focused explicitly on student application of literary analysis and interpretation, persuasive writing, and linguistic competency (VanTassel-Baska, Johnson, Hughes, & Boyce, 1996; VanTassel-Baska, Zuo, Avery, & Little, 2002).

Using a quasi-experimental design, selected school districts nationally have implemented one or more of these units. Comparison data were gathered from students of comparable ability in the same schools. Post-tests were administered after approximately 36 h of instruction, and between-group analyses were conducted using an ANCOVA to covary pre-test differences. Elementary and middle school students from a national network of schools participated in the sample, including volunteer schools from seven states. Implementation involved 2189 students in experimental and control classrooms in nine schools. All participating teachers received implementation training for 2 to 5 days.

Curriculum effectiveness was assessed on two performance-based instruments modeled after existing instrumentation developed by the National Assessment of Educational Progress in Reading (National Assessment Governing Board, 1992). The first assessment was a performance-based test of literary analysis and interpretation. Rubrics and exemplars evolved from pilot testing of a literary analysis assessment. The second instrument was a performance-based persuasive writing assessment, the rubric for which was based on a rubric used in earlier studies to assess thinking in persuasive writing. Both assessments were reviewed for content validity by experts in English and gifted education and were given favorable reviews. Interrater reliability estimates for scoring each instrument exceeded .90 for each scorer team (VanTassel-Baska et al., 2002).

Participating districts were recruited from summer and other training institutes from 1996 to 2000. Guidelines for participation included (a) the designation of an on-site coordinator, (b) selection of at least one experimental and one comparison class, (c) a written description of general district demographics and program descriptors (i.e., grade level, grouping arrangement, and duration of intervention), and (d) permission from an authorized district official.

Post-test analyses were conducted using an ANCOVA that covaried pre-test between-group differences. Effect sizes were calculated for all analyses involving comparison groups.

The four William and Mary language arts units employed in the study showed significant pre-post student gains and significant differences between the experimental and comparison groups ($p<.001$); effect sizes were very high for persuasive writing at 2.42 and high for literary analysis at .70. Repeated exposure to the units produced significant gains as well ($p<.05$). Low SES students showed significant gains in both literary analysis and interpretation and persuasive writing ($p<.001$). Gender differences found were small and not educationally important.

An analysis of a subsample from one of the school districts that targeted low-socio economic learners for intervention found that gains in persuasive writing were greater than for the rest of the sample, suggesting the high success potential of the curriculum for this population. A further analysis of student responses from the field-test sample was also conducted, showing that more than 50% of the students had room to grow in higher-level skill categories such as elaboration and interpretation, suggesting that the curriculum was sufficiently challenging for high-ability learners.

Although enhanced student learning is the primary indicator of curriculum effectiveness, teachers' favorable experiences with materials and related instructional strategies are also important. Such experiences support teacher acceptance of the materials and contribute to sustained use over time. Teacher acceptance was evaluated and found to be high in respect to curriculum elements employed, challenge, and reuse

(VanTassel-Baska et al., 1996). Findings from a six-year longitudinal study which examined the effects over time of using the William and Mary language arts for gifted learners in a suburban school district suggested that gifted student learning at grades 3 to 5 was enhanced at significant and educationally important levels in critical reading and persuasive writing. Repeated exposure over a 2 to 3 year period demonstrated increasing achievement patterns and the majority of stakeholders reporting the curriculum to be beneficial and effective (Feng, VanTassel-Baska, Queck, Bai, & O'Neill, 2005). Moreover, a study of using selected school districts demonstrated that the curriculum also impacted positive school change (VanTassel-Baska, Avery, Little, & Hughes, 2000).

6.2. Project Athena findings

Based on the growing research evidence on the use of The College of William & Mary's language arts units with gifted learners, the team at William and Mary began a three-year longitudinal study of using the curriculum in Title 1 schools and inclusive classrooms with all learners (VanTassel-Baska & Bracken, 2008).

Using an experimental design, 28 experimental classrooms implemented a William and Mary unit in grades 3, 4, or 5. More rigorous assessment was included in this study: an investigator-developed Test of Critical Thinking (TCT) and the use of the reading comprehension section of the Iowa Test of Basic Skills (ITBS) in addition to the performance-based measures used in earlier studies.

The longitudinal sample for this three-year study was 1346 students, with 735 in the experimental group and 611 in the control group. Formal training for teachers in the implementation of the units was conducted for four days across each year. Data analysis featured the use of MANOVA to assess pre-post results for between-group differences. Effect sizes were calculated for all groups. Results suggested that students in experimental classes showed significant and important educational gains in critical thinking with effect sizes at the moderate level across three years ($p < .05$). While control students also showed significant gains in critical thinking, significant differences favored the experimental group with small effect sizes of $\hat{\eta}^2 = .037$. All groups within the experiment showed gains including gifted, high readers/promising learners, and typical learners. On the ITBS, reading comprehension subtest, both the experimental and control students showed significant growth. Performance-based measures also yielded significant and educationally important results for the experimental students in all ability groups, suggesting that the curriculum is effective with a broad range of learners.

Data were also collected on teacher change as a result of both training and use of a differentiated curriculum. Pre-post data using a classroom observation instrument (the COS-R) suggest that experimental teachers showed significant growth patterns in the use of key elements of differentiation (i.e. critical thinking, creative thinking, accommodation to individual differences) across two years of implementation of the William and Mary units of study in comparison to control teachers not trained in the curriculum.

6.3. Research design and central findings from science curriculum effectiveness studies

One quasi-experimental study tested the effectiveness of the William and Mary problem-based learning science curriculum with gifted learners on designing original scientific experiments. It was hypothesized that gifted learners, using a PBL curriculum designed for higher-level concept development and thinking, would outperform equally able learners not using the intervention in the dimension of scientific research skills. The sample consisted of 62 classrooms in grades 2–7 in 7 states. Instrumentation was a pre-post performance-based assessment of integrated science process skills developed by Fowler (1990) and validated for such use by Adams and Callahan

(1995). Procedures for the study involved the training of teachers on the intervention for 5 days and the pre-post administration of the Fowler test in treatment and comparison classes. Analysis of covariance and paired-samples t-tests were employed to test differences between experimental and control students; effect sizes were also calculated. Significant and important treatment effects for integrated scientific process skills as seen in a student-generated experimental design were found for experimental groups over controls. No significant gender effects were found. Students improved significantly after unit instruction regardless of the grouping model employed. All students exposed to the units (average and gifted) enhanced their learning at significant levels (VanTassel-Baska et al., 1998).

Additional findings on the efficacy of the science curriculum come from a six-year longitudinal study which examined the effects over time of using the William and Mary science units (Feng et al., 2005). The results of this study were seen as important in that it examined the use of the problem-based learning units across cohort groups in the same school district to assess whether growth gains continued to accrue across the implementation of multiple units over three years. This study examined students at grades 3, 4, and 5 who had been exposed to three problem-based learning units. Using similar analyses to those conducted in the earlier study, findings suggested that gifted students in a pull-out program grow significantly each time they are taught a problem-based unit and showed steady gains from pre to post each year (Feng et al., 2005).

An evaluation study was conducted to assess the impact of the William and Mary curriculum on school and district change (VanTassel-Baska et al., 2000). This study found that school districts using the curriculum in one state experienced positive change in school practices and procedures and district policies.

6.4. Findings from Project Clarion

Recent quasi-experimental research on units of study designed for K-3 students in the area of science suggests that students across all ability levels and age levels benefit from the specially designed units in the areas of concept development and scientific research process at significant and educationally important levels. The units are designed to focus on scientific investigation skills, a macroconcept like change or systems, and a science content topic. A critical thinking measure used to assess general critical thinking was administered at the end of third grade to both experimental and control, yielding significant differences with mild effect sizes ($d = .34$) favoring the experimental group. Teacher effects also emerged as important since fidelity of implementation revealed that those teachers rated at the 25th percentile or lower on the teacher fidelity scale had students who showed limited gains in comparison to teachers who had implemented the curriculum at higher levels (Kim, VanTassel-Baska, Bracken, Feng & Stambaugh, submitted for publication).

Project Clarion research further suggested that the use of performance-based assessments was effective in understanding the developmental progression of skills among primary age children in respect to science conceptual understanding (VanTassel-Baska, Bracken, Feng, & Stambaugh, 2009) and in assessing important learning that occurred across 24 h of instruction (Bland, VanTassel-Baska, Bracken, Feng, & Stambaugh, submitted for publication).

6.5. Research design and central findings for social studies curriculum effectiveness studies

A quasi-experimental study was designed to assess the efficiency of the William and Mary social studies curriculum with gifted learners and typical learners in heterogeneous settings in six schools in a suburban Virginia enterprise zone school district. It was hypothesized that students exposed to a specific curriculum intervention in social studies would outperform similar students not using the intervention

on measures of concept and content learning and critical thinking. It was also hypothesized that teachers trained in the project pedagogy would show change over time in observed and self-reported behaviors supporting high-end learning. The sample consisted of 1200 students in grades 2, 4, and 7 in six schools.

Instrumentation included an evaluator-developed conceptual thinking assessment, with forms for primary, intermediate, and middle school; an evaluator-developed critical thinking assessment, with relevant multiple forms; unit-specific content tests that were investigator-developed; and, *The Classroom Observation Scale (COS)*, used to observe fidelity of training and implementation.

Procedures for the study involved training for teachers on the intervention, ranging from one to four days for each teacher, with some teachers having participated in two previous years of piloting, and a pre and post-test administration in treatment and comparison classes. Analyses included an analysis of covariance and paired-samples *t*-tests. A descriptive analysis of teacher behaviors was derived. The treatment group showed significant gains in conceptual reasoning, critical thinking, and content learning (Little, Feng, VanTassel-Baska, Rogers, & Avery, 2007). Gains were significant in comparison to the control group on the content assessment and on specific items on the other two assessments. Gifted students showed greater gains than did their non-gifted classmates. No significant gender differences appeared on any of the measures (Little, Feng, VanTassel-Baska, Rogers, & Avery, 2007). Differences in depth of implementation across schools and teachers corresponded to differences in performance among students. Teachers rated themselves significantly higher on all categories of performance than did external observers. Observation results from external observers showed significant gains for teachers in the category of critical thinking strategies. Findings suggest that the curriculum can be used in inclusive classrooms and show gains for all students.

In summary, the research evidence for the effectiveness of the curriculum developed on the ICM model is strong and convincing in each subject area where it has been assessed.

7. Implementation considerations

This section of the paper describes several considerations that educators should take into account in implementing the model: scaffolding of learning, the learner, context variables such as grouping, teacher training, and fidelity of implementation.

7.1. Models as scaffolds for the ICM

The ICM has consistently employed selected teaching and learning models as a way to reinforce desired dimensions of learning. These models are the core emphasis used in the training program on using the William and Mary curriculum and become critical in effective implementation. Three such models are described to illustrate how they exemplify each of the three dimensions of the model.

7.2. Advanced content: preassessment and compressed basic curriculum

The Center for Gifted Education utilizes preassessment and content compression in a series of steps as a scaffold for, and integral part of, the ICM. As the first step the ICM employs the use of preassessment in all three of the model's dimensions. In this step, students' needs are established and documented by asking "What do students know and need to know how for the particular unit, skill or concept?" Next, students' goals and objectives are established for the ensuing unit of study. The second step is constituted by the reorganization of core curriculum by eliminating unnecessary skill review and known concepts. In the third step, students are grouped together based on the preassessment via cluster grouping, ability grouping, cross-grade level grouping or flexible grouping within a grade level to work on their tested level of proficiency within the curriculum area.

Acceleration options in the William and Mary units include the use of higher, advanced grade level standards, advanced graphic organizers, products and task demands. The last step in effectively emphasizing advanced content work is the maintenance of records including parent conferences, documentation of student growth and student readiness and ability, and other record keeping for planning and further assessment beyond the current grade level.

In order to satisfy the need for advanced content, the language arts curriculum (Center for Gifted Education, 1999), developed for grades K-12, uses advanced literature selections that are two years beyond grade reading level. The writing emphasis is on persuasive essays that develop argument, which is a more advanced form of writing than is typically taught at elementary levels. Use of advanced vocabulary and the mastery of English syntax at the elementary level is also stressed. Science units developed from the ICM stress student-determined mastery of science content through the problem-based approach as well as formative and summative assessment of science content learning. Social studies units offer advanced in-depth studies of key periods in U.S. and world history that were influential, with an emphasis on the use of primary sources.

7.2.1. Process and products: thinking skills

Engaging gifted learners in higher-order process skills is an important element in the ICM and in implementing effective curricula for gifted and high-ability learners in general. Gifted students need to become proficient in thinking and problem-solving strategies that examine concepts central to specific disciplines, but that are also common to different fields of study. Incorporating a specific model such as Paul's Elements of Reasoning (Paul & Elder, 2001) into a framework for teaching heightens the potential for student learning well beyond current levels (Struck, 2003, p. 76).

7.2.1.1. Paul's Elements of Reasoning. Comprised of key aspects of thought which are the building blocks of productive thinking, Paul's (1992) Elements of Reasoning provide a general logic to reasoning which are implicit in gathering, conceptualizing, applying, synthesizing, and evaluating information (cited in Struck, 2003). These elements are described by Struck (2003) in more detail below:

1. *Purpose, goal or end in view:* Because people generally reason in order to achieve an objective, satisfy a desire or fulfill some need, students require a clear purpose in writing or speech in order to focus the intended message in a coherent direction. If the outcome or result is unrealistic, confusing or conflicting with the student's belief system in some way, then the reasoning used to achieve that result or outcome will be difficult and problematic.
2. *Question at Issue (or Problem to be Solved):* If reasoning is required, then there must be a question, problem, or issue to be solved. If a student is confused as to what the problem at hand is, it is doubtful they will find a clear or reasonable answer. Students need to be able to formulate the question to be addressed.
3. *Points of View or Frame of Reference:* All students come with a unique perspective or "take" on an issue which can influence the way they reason. If the student's point of view is too narrow, imprecise, or biased problems in reasoning will be encountered. Learners need to be able to consider multiple points of view, sharpen or broaden their thinking in order to provide strong arguments for or against other perspectives. A careful exploration and acknowledgement of his or her individual point of view will enable the student to hone the required reasoning process.
4. *Experience, Data, Evidence:* All learners should be able to support their perspective with reasons or evidence. Evidence is the difference between giving opinions and stating facts in order to create a thoughtful judgment. By examining the supporting data or evidence, students can evaluate the strength of an argument.

5. *Concepts or Ideas:* Students learning to reason should understand the use of concepts and ideas in such a way that they can identify key ideas and organize thoughts around them.
6. *Assumptions:* Learners need to be aware of assumptions or suppositions they may take for granted when reasoning which can lead to difficulties in reasoning. It is important for learners to clarify perspectives, presuppositions, beliefs and assumptions made by different stakeholders affected by an issue.
7. *Inferences:* A student's ability to draw conclusions based on data depends on the skill he or she has in making sense of individual situations and the reliability of available data. As students reason they should be aware of distinctions between experiences and interpretations, conclusions or inferences based on those experiences.
8. *Implications and Conclusions:* The ability to understand and articulate implications and consequences of an issue or perspective is crucial to a student's reasoning. Students should be able to listen or read an argument and vocalize the implications of following the specific path outlined by the issue.

The Elements of Reasoning are used as a framework for developing lessons in various subject areas to enhance critical thinking as a part of the ICM model.

7.3. Concept dimension

Curriculum developers have long acknowledged the importance of concepts as central to the conceptualization and content of units of instruction in the education of gifted learners. Concept learning is crucial in a gifted learner's acquisition of big ideas and instrumental in facilitating their reasoning processes including deductive and inductive thinking. Inferring from the specific to the general or deducing from the general to the specific involves understanding the nature of generalities, and generalities constitute conceptual understanding (Avery & Little, 2003).

Concepts provide "important pathways between the disciplines so that separate aspects of knowledge are understood as being integrated" (VanTassel-Baska, 1998, p. 347) and have the power to deeply engage teachers and students with the material, provoking curiosity and inquiry (Schack, 1994). Thus, concepts which are relevant to real life not only link disciplines together, they also dynamically link the learner to the content (Avery & Little, 2003).

Ehrenberg (1981) described three key characteristics of concepts. First, all concepts are abstract because they "constitute[s] a generalized mental image of the characteristics that make items examples" (p. 37). Although concepts themselves are abstract, the individual characteristics that define an item as belonging to the concept may be concrete, abstract or a combination of both. When concepts are spoken of in the context of curriculum development, generally they are concepts with characteristics that are more abstract in nature, or, the "big ideas" (Avery & Little, 2003). A second feature of concepts is that they cannot be verified, like facts, as being "right" or "wrong". Their meaning is socially constructed, hence a student's understanding of a concept is dynamic. Third, concepts are hierarchical. The thoughtful consideration of conceptual hierarchies ensures that the central concepts selected for study by the curriculum developer are broad and deep enough to facilitate reasoning and critical thinking.

Concepts underscore all human thought and communication, and individuals develop conceptual understandings as a part of the natural learning process (Ehrenberg, 1981). However, students need to be guided through a structured and supportive process of concept development. Teachers can facilitate gifted learners' process of concept development by providing contexts in well organized activities and lessons that lead step-by-step to deeper understandings (Avery & Little, 2003). The concept development emphasis in ICM units is based on the work of Taba (1962), a major theorist in the area of curriculum development. The process is a constructivist one that asks students

to 1) identify examples of a concept, 2.) organize and reflect upon it, 3.) provide counter examples of the concept, 4.) develop generalizations, and then 5.) apply those generalizations to previous and future knowledge.

Teachers can create different instructional strategies that address these elements and which allow students to construct understanding in a more powerful manner than didactic strategies. Lessons that address concept learning can be stacked throughout a unit of study in order to scaffold the learner through sequenced steps from awareness via initial exposure to a deeper understanding and application of concepts through repeated reinforcement (Avery & Little, 2003). Assessment strategies tied to concept learning can be structured on a pre- and post-basis and also in an embedded approach as well. The ICM model employs all of these approaches to concept learning.

Change is used as a central organizer in the Center for Gifted Education's series of language arts units (Center for Gifted Education, 1999). In these units, students progress through the stages of concept development activities cited above and at the conclusion are presented with a list of the following generalizations about the concept. These generalizations, based on a cross-disciplinary review of the literature, include: "change is pervasive," "change is linked to time," "change may be perceived as systematic or random," change may represent growth and development or regression and decay," "change may occur according to natural order or imposed by individuals or groups." Students' own generalizations are aligned with this list and validated through discussion and activities throughout a related unit.

The science curriculum emphasizes the concept of systems as a way to study the domains of biology, chemistry, physics and geology. The concept of systems also was applied to understanding structures in society, such as economic and political systems; other units emphasized connected chains of cause and effects to help students understand multiple causation in history and to recognize that historical events were not inevitable (VanTassel-Baska, 2003b). Other social studies curricula focus on additional concepts, such as nationalism and perspective. Concept papers have been written to demonstrate these connections as a support to curriculum developers and to teachers implementing the curriculum successfully (e.g. Boyce, 1992; Pence, 1999; Sher, 1991).

The ICM emphasis in content, high-level processes and products, and concepts provides both models for organizing curriculum but also scaffolds for teaching it as seen through the examples provided.

7.4. Implementation variables

While the need for a match between the learner and the intervention has already been described, it is also important to highlight the important contextual considerations that could impact the successful use of the ICM in school settings. There are at least four variables that must be considered: flexibility in student placement and progress, grouping, teacher training, and a general climate of excellence.

7.4.1. Flexibility in student placement and progress

Even an enriched and accelerated curriculum developed for high-ability learners that addresses all of the educational reform principles cannot be used without careful consideration of entry skills, rate of learning, and special interests and needs. Thus, ungraded multiage contexts in which high-ability learners access appropriate work groups and curricular stations represent an ideal component of the implementation context. Pretesting of students on relevant skills is a central part of the ICM-based curriculum, and diagnosing unusual readiness or developmental spurts that may occur in a curricular sequence is also important. Schools may notice and use such data as a basis for more in-depth work in an area of a particular teaching unit. For most gifted programs, the ICM-based curriculum is ideally suited to students identified in intellectual and academic areas. For each of the

content areas, students who possess advanced abilities in only one area of learning may benefit from the curriculum designed in that area.

Most of the curriculum developed from the model has taken six years from initial design to final dissemination. Part of that time span has always been devoted to piloting the curriculum in multiple teachers' classrooms and using the resulting data to revise units of study. Tryouts allow developers to see how individual lessons work with gifted learners as well as to allow for appropriate revisions at a beginning stage of the process. Rarely does curriculum work the first time through. Refinement is a critical part of ensuring the optimal match between the learner and the curricular challenge.

7.4.2. Grouping

As a curriculum for high-ability learners is implemented, attention must be paid to the beneficial impact of grouping for instruction. As Kulik's (1992) reanalysis of the grouping data demonstrated, when curricula are modified for gifted students, the positive effects of grouping become more prominent. Moreover, classroom-based studies have verified that little differentiation is occurring in heterogeneous classrooms for gifted students (Archambault et al., 1993; Westberg & Daoust, 2003) and the majority of teachers in our schools are not trained to teach gifted learners (Westberg, Archambault, Dobyns & Salvin, 1993). Thus, forming instructional groups of gifted students for implementation of the ICM curriculum is clearly the most effective and efficient way to deliver it. Whether such grouping occurs in separately designated classes or in regular classrooms is a local consideration rather than dictated by the model. The effectiveness of the curriculum in various grouping patterns has already been established through controlled studies (VanTassel-Baska & Bracken, 2008; VanTassel-Baska et al., 2002).

7.5. Teacher training

Based on data confirming the significant role of teacher training in providing differentiated instruction for the gifted (Hansen & Feldhusen, 1994; Tomlinson et al., 1994) and the availability of coursework in the education of the gifted (Parker & Karnes, 1991) there is good reason to place gifted students with teachers who have received at least 12 university hours of professional training. The benefits to gifted learners become greater when a differentiated curriculum is handled by those sensitive to the nature and needs of such students. Training in the direct implementation of curricular materials to be used is also necessary to prepare teachers effectively for implementation of curriculum based on the ICM. Depending on the experience of the teachers involved, about two to four days of training in the various approaches employed in the curriculum materials have generally supported initial implementation.

7.6. Fidelity of implementation

One of the biggest challenges facing any curriculum developer is getting teachers to implement a unit of study as it was written so that the innovation can be assessed accurately, and changes made for improvement. A process for assessing the degree of fidelity during implementation must be built into any curriculum project. Usually classroom observation using a structured form is the optimal tool to ensure that this occurs, but follow-up professional development on key aspects of the curriculum is also often required to ensure that teachers transfer completely to their strategy repertoire the salient instructional aspects of the new curriculum to be taught.

In the implementation of ICM, it is important not to leave such processes to chance. One that is frequently overlooked in the rush to practice is making the right inferences about the appropriate use of a strategy. If the work with teachers includes a sample lesson plan or unit of study where the strategy is embedded, it is better than only teaching the strategy out of context and expecting the teacher to find

the applicability. Guided practice of strategy use in the context of an ICM unit is an ideal way to ensure teacher use. Teachers' growth in the use of differentiation is also a benefit of faithful implementation of ICM as seen in our recent studies using the COS-R (VanTassel-Baska et al., 2008).

7.6.1. Climate of excellence

In order for gifted learners to perform at optimal levels, the educational context must offer challenging opportunities that tap deeply into students' psychological states (Csikszentmihalyi, Rathunde, & Whalen, 1993), provide generative situations (VanTassel-Baska, 1998), and also demand high standards of excellence that correspond to expectations for high-level productivity in any field (Ochse, 1990). More than ever, the climate of a school for excellence matters if curricular standards are to be raised successfully for any student. Such a climate is clearly essential for disadvantaged gifted youth who are put more at risk by lowered expectations for performance (House & Lapan, 1994). For gifted students in particular, such a climate must be in place to ensure optimal development, positive attitudes toward learning, and engagement (VanTassel-Baska, 2003b).

8. Conclusions

Perhaps most cogent among our findings over the past decade is the reality that curriculum designed for gifted learners using ICM makes a difference in the nature and extent of learning that these students will accrue. It also appears to be a powerful motivator for the less able, especially the scaffolding provided by the instructional models. If we design curriculum for our best learners and use it to stimulate a broader group of learners, then we will have succeeded admirably in our efforts to raise the ceiling for the gifted, but also to provide a new set of standards for others to aim for, an increase in mean achievement for all, but greater variance in advanced learning for the gifted.

In order to assess the effectiveness of any innovation over time, multiple approaches to analyze the impact must be employed. Our work has examined student growth in higher level processes, teacher growth in the use of differentiated strategies, school-based change in practices, and district level policy changes. For an innovation to be seen as successful, positive results in all of these arenas and levels of the educational enterprise would be helpful. Analysis at these levels requires both in-depth qualitative studies on the issues surrounding implementation and school change results and large scale randomized experimental studies that demonstrate growth patterns for students and teachers that can generalize to multiple contexts. Thus, the work on ICM will continue as new directions for curriculum development in subject areas such as the arts, foreign language, and leadership present themselves.

The ICM model has demonstrated, however, for more than a decade, a research-based and practical approach to designing curriculum for high-end learning. Through its emphasis on a research-based integrated approach to design, through its coupling with content-based standards as a departure point, and through its extensive research program that documents effectiveness with gifted learners, at risk learners, and typical learners as well as teachers, the model has more than proven its utility.

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