BEAVERTON
SCHOOL DISTRICT
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BOARD MEETING DATE
April 30, 2013

Achievement by Special Populations (TAG)

As part of the Strategic Plan the Board requested that information regarding student achievement by special populations be reported on in order to gain a better understanding of growth targets. The following is a report on TAG student achievement.

Achievement by Special Populations (TAG)

Introduction:

In 2008-2009, the Beaverton School Board charged the Superintendent to form a TAG Project Team to make recommendations regarding the District's Talented and Gifted Program. Within the report presented to the School Board in June 2009, the Talented and Gifted Position Paper states: "The education program for talented and gifted students in the Beaverton School District is based on the belief that gifted students need intellectual peer stimulation and curriculum differentiation as well as a dynamic learning environment in every classroom." This reflects the intent and focus of the District work over the past four years, which included the work of the TAG Implementation Team.

The TAG Project Team brought forward five recommendations that outline specific areas of focus to prioritize and further support growth and development of TAG services. The District has directed work on all five recommendations and has prioritized specific areas based on available resources. As stated in the TAG Project Team Report on "Priorities for Action", "While some of the elements do not require additional funding, successful implementation of these elements will require funding for staff development." The reduced budget for professional development over the past five years has impacted the TAG budget and the capacity to provide professional development on all five areas. However, learning and growth in all five areas is evident in K-12 schools and classrooms.

Below is an overview of the five TAG Project Team "Priorities for Action" and the status of implementation and learning in these five areas. Specific attention is paid to work in the 2012-2013 school year.

TAG Project Team Priorities for Action

Priority 1: Professional Development

One of the priorities for action identified by the TAG Project Team was increased professional development for teachers, administrators, and parents. In 2012-13, specific professional development opportunities for Beaverton teachers addressed effective strategies for engaging gifted learners, including curriculum compacting, high-level questioning strategies and conceptually-based unit planning. These included:

Professional Development for Teachers:

Junior Great Books - Elementary and secondary teachers participated in the Junior Great Books training in late fall. Junior Great Books is a highly developed, structured program encouraging careful reading of complex materials. Discussions of the readings are designed to be challenging and interesting and to focus on the universal themes that are present in the books. Elementary teachers who came with their grade level team were provided with teacher and student editions for use in their building.

Differentiation and Developing High Level Tasks –Jann Leppien, a former research assistant at the National Research Center for the Gifted and Talented at the University of Connecticut provided two-day professional development at both the elementary and secondary level, highlighting the continuum of ascending intellectual demand, thinking tools, differentiation, and unit planning for conceptual understanding. Teachers left having collaboratively created integrated units and are asking for future time to support implementation.

Curriculum Compacting: Jason McIntosh, from Purdue University will present Curriculum Compacting to elementary teachers on April 25, 2013. Curriculum Compacting is an instructional technique that is specifically designed to make appropriate curricular adjustments for students in any curricular area and at any grade level. Essentially, the procedure involves (1) defining the goals and outcomes of a particular unit or segment of instruction, (2) determining and documenting which students have already mastered most or all of a specified set of learning outcomes, and (3) providing replacement strategies for material already mastered through the use of instructional options that enable a more challenging and productive use of the student's time.

In addition to professional development opportunities, TeacherSource, the media-rich exchange network for teachers in the Beaverton School District, is being utilized to give teachers access to high-quality instructional materials and resources to address the needs of advanced learners. Over 200 additions have been made to TeacherSource on the following topics:

- Advanced Readers
- Advanced Mathematicians
- Contests and Events
- Differentiation
- Depth and Complexity
- Questioning Strategies
- Gifted Education 101
- Twice Exceptional Students
- Games that Gifted Students Love

Book Clubs using the following texts were offered this year for K-12 teachers:

Professional books:

- Mindset by Carol Dweck
- Drive by Daniel Pink
- Switch: How to Change Things When Change is Hard by Dan Heath
- Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School by John Medina
- The Talent Code by Daniel Coyle
- Focus by Mike Schmoker
- Nurtureshock by Po Bronson and Ashley Merryman
- Incognito: The Secret Lives of the Brain by David Eagleman

Student titles (recently published with great potential for gifted students)

- So, You Want to Be a Writer? How to Write, Get Published, and Maybe Even Make It Big! by Vicki Hambleton and Cathleen Greenwood
- Wonder by R.J. Palacio
- Mr. and Mrs. Bunny - Detectives Extraordinaire by Polly Horvath
- The One and Only Ivan by Katherine Applegate
- Titanic: Voices from Disaster by Deborah Hopkinson
- One for the Murphys by Lynda Hunt
- Remarkable by Elizabeth Foley
- Superman versus the Ku Klux Klan: the True Story of How the Iconic Superhero Battled the Men of Hate by Richard Bowers
- Same Sun Here by Silas House and Neela Vaswani

Parent Education Opportunities:

The Department of TAG Services provided Workshops on Wednesdays for parents, counselors and teachers again this year with the average attendance of 80 people per session. The following topics were offered:

- September 26 - Parenting the Gifted Child
- October 24 - Living with Intensity
- November 7 - Helping the Gifted Underachiever
- February 20 - Twice Exceptional Learners
- March 6 - Perfectionism
- April 17 - Habits of Mind

Ann Matschiner, professor at Pacific University, facilitated a book group for both students and their parents on Mindset in October. Parents recommended additional topics to be considered for sessions next year.

Priority 2: Total School Cluster Grouping

Elementary Schools
Three years ago, two elementary schools implemented Total School Cluster Grouping as part of a study through Purdue University. These schools were provided with professional development modules through the Purdue grant, which enabled each school to progress to implementation. An additional four elementary schools have implemented TSCG during the last two years.

Grouping Definitions

Total School Cluster Grouping	The practice of identifying and placing gifted students in the same appropriate grade level classroom with a teacher knowledgeable in meeting the needs of gifted students.
Flexible Achievement Grouping	Arranging students by interest or need. Movement among groups is common, based on readiness for a given skill or academic mastery.
Ability Grouping	Arranging students by ability to meet various instructional purposes. These groups are specific to the educational goals to be achieved and re-formed as needed. Ability grouping is NOT synonymous with tracking.
Homogeneous Grouping	Placing and grouping students together according to similar abilities, interests, and special academic needs. These groupings can occur across grade levels, within specific interests areas, and for extended or limited periods of time.

Successful Implementation of Total School Cluster Grouping

As with any educational program, a model is only as strong as its theoretical underpinnings, research basis, and as the people who implement it. This statement holds true, as well, for cluster grouping. In order for this model to succeed, it requires knowledge of the students for whom the model is provided, a willingness to collaborate, and a continual approach to professional development. The rationale, research, and goals have been outlined and serve as the conceptual basis for developing a site-specific application of Total School Cluster Grouping. The developed application should reflect the intent of the Total School Cluster Grouping Model while taking into account the nuances and needs of the community of the school in which it is developed.

The identification and placement of students is an important and time-consuming task. However, it is what takes place after the placement that really makes the model successful. By grouping students in clusters, classrooms are organized to meet students' individual needs. The strategies teachers use to challenge and meet their students' needs are integral for student growth and true model implementation.

Strong administrative and teacher support is essential for effective implementation. The identification process alone requires time outside of class for teachers to identify and assign students to classrooms. Unlike pullout or self-contained programs, cluster grouping involves the placement of students of all achievement levels, not just the high ability students

Prior to implementation, it is important that the team of school personnel makes a commitment to some very targeted professional development. Within each classroom, teachers will be dealing with a narrower range of students, but students who still present a variety of needs. Therefore, professional development focusing on grouping, differentiation, and meeting the needs of high ability learners will be required for the entire staff.

Initially, the school may need to seek help from outside to conduct such training. However, as the program develops and teachers become more comfortable and well versed in strategies that work, the need for outside presenters will lessen. There will always be merit in keeping perspective by including strategies and ideas from outside of the local program, however. Good professional development is ongoing. Even the best models and strategies continually need to be revisited and updated to fit the needs of a school's current population.

Role of the Cluster Classroom Teacher

When teachers' practices include the following elements, cluster grouping can yield positive results:

- Participate in ongoing professional development
- Foster a positive classroom environment where divergent thinking is appreciated and nurtured
- Maintain high, yet realistic expectations
- Implement strategies to challenge individual students' needs
- Provide ongoing assessment to determine baselines, academic readiness, and demonstrated growth
- Provide flexible grouping opportunities for the entire class
- Provide opportunities for faster pacing of new material
- Incorporate students' passionate interests into their independent studies

- Adapted from Total School Cluster Grouping & Differentiation by Marcia Gentry & Rebecca L. Mann

A financial investment is needed in teacher and administrator training in Total School Cluster Grouping and differentiation practices if we are to continue to increase the number of schools using TSCG. TSCG expert Marcia Gentry is meeting with District administrators to discuss implementation and best practices in late April 2013.

Middle Schools

There is a lack of research of Total School Cluster Grouping at the middle level. According to Marcia Gentry, TSCG is not a recommended model for middle schools.

Many middle school teachers confidently flexibly group students within and among their classrooms, using a variety of strategies for enrichment and intervention, including the use of stations, grouping students relative to achievement of certain targets, accessing reading material at varying levels, and scaffolding for high level concepts.

One example of effective flexible grouping across an entire grade level is regrouping 8^{th} grade math students for the third trimester based on their high school forecasting course. In a Language Arts class, students engage in "Lit Kits" instead of traditional literature groups or novel studies. In "Lit Kits" students read several books within a greater theme and discuss regularly with students who have read books within that theme. This enables teachers to pair students with books at their reading level.

As the data indicates, however, there continues to be a need for training and follow-up communication with colleagues about best practices in effective differentiation.

<u>Priority 3</u>: Underrepresented Populations

The third priority of the TAG Project Team was to increase number of TAG identified student from underrepresented populations. Although the practices below are in place, the identification of underrepresented populations continues to be a challenge.

- Blanket testing in grades 2 & 4 to get baseline data on every student in intellect.
- TAG Specialist attends information evenings for Native American families to provide TAG information and resources. In addition, TAG Services and the Beaverton Welcome Center are working on summer workshops for this population in late June.
- TAG Specialist provides Parent/Child Creativity evenings for several Title schools with enrichment ideas and resources that can be used at home.
- Investigation of using local norms for scoring the CogAT.
- Concentration on the teaching of critical and creative thinking skills.

<u>Priority 4</u>: Full-time TAG position in all schools

In the 2012-2013 school year, the District maintained the facilitator position (with stipend) in elementary and middle schools; however, the three release days TAG facilitators were granted in previous years have been reduced to one day in 2012-2013. In addition, sub time granted for facilitators to meet has been cut. The TAG facilitator position was removed at the high school level, but a designated Associate Principal, as well as the AP and IB coordinators, are serving as contact people for TAG identification and events.

TAG Facilitator extended responsibilities include the following:

- Partner with principal, articulation team members, and content facilitators to identify and implement differentiated instructional strategies for all students.
- Assist teachers with TAG identification process and ongoing assessment/instruction at the appropriate rate and level.
- Advocate for TAG students in your building.
- Share best practices and issues in gifted education with staff, and facilitate the sharing of ideas and TAG-related classroom materials in your school.
- Work with your school's TAG committee to develop a plan to meet the needs of students, to provide ongoing communication to parents, and to ensure the accuracy of school-based records concerning TAG students.
- Serve as a resource for parents who have questions or concerns about TAG.
- Attend district level meetings with other district TAG facilitators to organize school and district activities.
- Assist with the implementation of the Plan and Profile.
- Use Synergy to generate reports and letters.

Priority 5: Curriculum

Developing programs that hold all students to a high intellectual standard is our top priority. To this end, the Beaverton School District is supporting the expansion of IB's Primary Years Program and the implementation of the key instructional shifts of the Common Core State Standards. Please see attached information on CCSS instructional shifts and the attached Davidson Institute article.

"Rigor is more than what you teach and what standards you cover; it's how you teach and how students show you they understand. True rigor is creating an environment in which each student is expected to learn at high levels, each student is supported so s/he can learn at high levels, and each student demonstrates learning at high levels" (Blackburn, 2008).

PYP Expansion: Bonny Slope and Ridgewood Elementary are firmly established IB Primary Years Program schools. The PYP program has provided both buildings with a framework for teaching conceptually through the inquiry process, and they have had a high degree of success in providing rigorous instruction for all students. In a movement to expand the PYP, several teachers from each building were identified as "lab teachers". Throughout this year, these teacher leaders have opened their classrooms and provided professional development to five elementary schools in our district that are formally exploring IB's Primary Years Program (Hiteon, McKinley, Findley, Raleigh Park, and Elmonica). Raleigh Park has moved into the candidacy phase of PYP, and the remaining four "explore" schools will continue training to begin their PYP curriculum work during the 2013-2014 school year.

Common Core/Next Generation Science Standards: The National Common Core and Next Generation Science Standards have provided a K-12 framework for rigorous instruction in mathematics, English language arts, science, and social studies. Teacher articulation teams in the BSD at all levels have been unpacking and prioritizing the national standards to prepare for continued formal rollout this summer and fall.

According to the 2012 ASCD publication "Fulfilling the Promise of the Common Core", districts will need to provide effective, scaffolded professional development in order to build the capacity of teachers. They identify the following key needs:

- Time to plan to implement the new standards
- Resources and guidance about best practices for ongoing, job-embedded professional development to build educators' understanding of the standards' structure, content, knowledge, and ability to employ strategies reflecting the new instructional shifts (see attached "Shifts" documents below)
- Resources to differentiate support for educators' varying levels of knowledge about the Common Core State Standards
- Guidance and support to help enhance professional learning through teacher communication and collaboration, such as professional learning communities
- Professional development and resources about how to engage the community and garner its support

Professional Development Facilitators, identified teacher leaders from each elementary and secondary building, have been supporting all teachers in implementation of the Common Core State Standards through their leadership at the building level. PD Facilitators have provided guidance in implementing the new standards as well as staff development on the following topics: formative assessment, engagement strategies, text-based debate, calibration, moderation and designing high-level assessments.

Additionally, the following courses (some required) have been scheduled for all teachers during the spring, summer and fall of 2013.

Mathematics Professional Development Courses - Secondary

The Beaverton School District will be providing professional development to support secondary math teachers in the transition to integrating the Common Core State Standards (CCSS) Mathematical Practices into the instructional practices and the assessment systems of all secondary math classrooms. The first step in providing this support is that all secondary (6-12) math teachers will be ***required*** to take one of two courses introducing the CCSS Mathematical Practices.

Purpose of Requiring Math Professional Development Courses

- The CCSS Mathematical Content shifts content to different grade levels, and the Mathematical Practices require a shift in pedagogy. The combination of changes necessitates professional development to create a baseline of understanding among all secondary math teachers
- The Mathematical Practices will be an integral part of the Smarter Balanced Assessment that will replace OAKS in 2014-15

Course Info

- All secondary math instructors teaching Algebra I at high school or middle school should enroll in the Algebra I / Physics course, *but it is open to any math teacher*
- Teachers will be paid per diem for summer courses. Teachers enrolled in the April/May course will be provided a sub
- 2 graduate credits from Portland State University available through the STEM/Tuition Reimbursement Program
- There will be optional follow up meetings throughout the school year
- Registration Period: **April 5th - April 19th**
- Register at TeacherSource

Math Professional Development Course Schedule

Title	Dates	Time
Using Physics to Bring Algebra I and the CCSS Mathematical Practices Alive	April 30, May 7, 14, 21	8:00 – 3:00
Using Physics to Bring Algebra I and the CCSS Mathematical Practices Alive	June 24 – June 27	8:00 – 3:00
Using Physics to Bring Algebra I and the CCSS Mathematical Practices Alive	August 19 – August 22	8:00 – 3:00
Power of Mathematical Practices	May 2, 9, 16, 23	8:00 – 3:00
Power of Mathematical Practices	June 18 – June 21	8:00 – 3:00
Power of Mathematical Practices	August 5 – August 8 & August 12 – August 15	9:00 – 12:00

Mathematics Professional Development Course Descriptions

Using Physics to Bring Algebra I and The CCSS Mathematical Practices Alive

There is a powerful connection between the long-term learning targets in the Beaverton School District's Physics First class and Algebra 1, especially through an integration of the Common Core State Standards Mathematical Practices. This course will explore how Algebra 1 teachers can use the data generated from a Conceptual Physics course to provide context and application to the functions explored in Algebra. Physics teachers will learn how the use of precise mathematical language, mathematical concepts and practices will enhance their instruction and bring a deeper understanding of the Physics concepts. Participants will collaboratively create units that integrate all the mathematical practices in a way that will make the Algebra come alive through connections to various contexts and applications. Each unit will include formative assessment practices and summative assessments that incorporate the Mathematical Practices, Mathematics Content and connections to Physics.

Power of Mathematical Practices

In this course, secondary mathematics educators will use the Common Core's Standards for Mathematical Practice to improve student learning and practices in mathematics. Educators will un-wrap the powerful connection between the Mathematical Practices and the Standards for Mathematics Content. Each educator will develop a unit to be implemented in the 2013-14 school year. These units will be created in collaboration with other educators and shared. Each unit will include formative and summative assessments that incorporate the Mathematical Practices and the Mathematical Content, including rubrics that will help teachers and their students determine what it means to be proficient in a given standard.

High School Language Arts & Middle School Humanities
Professional Development Courses

The Beaverton School District will be providing professional development to support secondary ***humanities*** and ***language arts*** teachers in the transition of integrating the Common Core State Standards (CCSS) instructional practices and the assessment systems into all secondary language arts classrooms. The first step in providing this support is that all secondary (6-12) teachers will be ***required*** to take a course outlining the changes and instructional impacts of the Common Core State Standards.

Purpose of Requiring These Professional Development Courses

The Common Core State Standards for English Language Arts (ELA), which have been adopted broadly across the United States, lay out a comprehensive vision of what it means to be literate in a changing world. There are several factors driving the need for professional development related to the implementation of the Common Core.

- Participants will explore significant instructional shifts, which include balancing informational/literary text, text complexity, close reading, text-based answers, academic vocabulary, and writing from sources.
- Teachers will have an in-depth discussion of the impact of the standards on instruction and assessment. In partnership with one another, participants will design a bank of assessments and resource materials for each long-term learning target.
- This course will provide an in depth exploration of the Smarter Balanced Assessment, which replaces OAKS in 2014-15. Smarter Balanced goes beyond multiple-choice questions, using performance tasks that will expect students to demonstrate application, critical thinking, and problem-solving skills.

Course Info

- Teachers choose either a school year option or a summer option.
- Teachers will be paid per diem for summer courses. Teachers enrolled in the September/October course will be provided a sub.
- Registration Period: **April 5th - April 19th**
- Register at TeacherSource

High School Language Arts & Middle School Humanities
Professional Development Course Schedule

Title	Dates	Time
ELA Common Core Instructional Practices	August 13 & August 14	8:00 – 3:00
ELA Common Core Instructional Practices	August 22 & August 23	8:00 – 3:00
ELA Common Core Instructional Practices	September 26 & September 27	8:00 – 3:00
ELA Common Core Instructional Practices	October 21 & October 22	8:00 – 3:00

High School Language Arts & MS Humanities
Professional Development Course Descriptions

In this two-day course, participants will explore the instructional "shifts" of the Common Core, including balancing informational/literary text, text complexity, close reading, text-based answers, academic vocabulary, and writing from sources. Teachers will have an in-depth discussion on the impact of the standards on instruction and assessment. In partnership with one another, participants will design a bank of assessments and resource materials for each long-term learning target to be posted on TeacherSource.

Participants from this course can become building leaders and potentially trainers as we move toward incorporating Common Core practices across all core content areas.

High School Science Professional Development Courses

In an effort to continue the momentum of transforming the high school science sequence and preparing students for college and career, all science teachers will be expected to address the scientific practices found in the soon to be released Next Generation Science Standards. In order to do this, teachers need to have the tools for incorporating theses practices into the classroom. As a result, all high school science teachers will be ***required*** to take one of three science courses. In addition to repeating the Physics course offered last summer, a STEM course on Chemistry and Biology have been developed. All classes will have optional follow-up PD sessions that will be held during the 2013-2014 school year.

Purpose of Requiring Science Professional Development Courses

- It allows the district to address specific issues within core instructional areas that have been identified as problematic. For example, student scores on the science portion of the ACT and OAKS Science Assessment were the lowest of all the core instructional areas.
- BSD goals of equity were not being met in science. Demographic factors could be used as predictors of success in past science courses and as predictors of the level of the rigor of science course sequences that students took.
- To continue to build on the work of this year's professional development in Physics so that a cohesive science sequence that builds rigor is fully implemented in all of BSD high schools. Our new science sequence provides the best opportunity for teaching critical thinking and problem solving skills to all students.
- Common teaching practices allow for collaboration and permits teachers to focus on student outcomes and differentiation.

Course Info

- Teachers choose either a school year option or a summer option.
- Teachers who took the STEM Physics training last summer and who are only teaching physics next year, do not need to take one of the summer courses. The 2013 Physics course is the same as the 2012 Physics course.
- The 2013 summer Chemistry course will be substantially different than the summer 2012 Chemistry course. Focus will be on active learning, inquiry, engineering, and patterns. Teachers who are teaching Chemistry next year will need to take this course, even if they took the course last year.
- Teachers will be paid per diem for summer courses. Teachers enrolled in the April/May course will be provided a sub
- 2 graduate credits from Portland State University available through the STEM/Tuition Reimbursement Program
- There will be optional follow up meetings throughout the school year
- Registration Period: **April 5th - April 19th**
- Register at TeacherSource

Science Professional Development Course Schedule - High School

Title	Dates	Time
Increasing STEM in Physics – HS Teachers New to Physics	May 29 & June 3 + 3 days in the Fall TBD	8:00 – 3:00
Increasing STEM in Physics – HS Teachers New to Physics	June 24 – June 28	8:00 – 3:00
Chemistry Patterns and Practices	May 31 & June 5 + 3 days in the Fall TBD	8:00 – 3:00
Chemistry Patterns and Practices	August 6 – August 9	8:00 – 3:00
Biology for the Next Generation	May 21 + 4 days in the Fall TBD	8:00 – 3:00
Biology for the Next Generation	August 19 – August 23	8:00 – 3:00

Science Professional Development Course Descriptions

Increasing STEM in Physics

This is a repeat of the 5-day course taught last summer. This course will specifically focus on implementing an inquiry-based curriculum that explicitly addresses the Science, Technology, Engineering, and Math (STEM) standards as laid out in the Oregon State Standards, the Common Core State Standards for Mathematics, and the Next Generation Scientific Practices and Cross Cutting Concepts. Teachers will learn how to guide students to proficiency through rigorous, experiential learning activities. This will primarily be achieved through teachers participating in guided instruction. Focus is on incorporating math rigor and inquiry and engineering practices as a primary mode of learning Physics. Four patterns seen in Physics are introduced as a major component of the course. Teachers will learn how to incorporate student discussion and learning through "Board Discussions". Teachers who attend this course, may also attend the year-long follow-up sessions on engineering.

Chemistry Patterns and Practices

This 4-day course will focus on helping teachers to build on the skills and practices that students gained in the freshman physics course. Teachers will learn how to intertwine the disciplinary core ideas of chemistry and the science practices as described in the Next Generation Science Standards. They will learn how to use inquiry experiments and engineering design to guide students through typical learning progressions. Teachers will learn the importance of identifying student misconceptions through formative assessment, so a solid conceptual knowledge of chemistry is attained. On day four of the class, teachers will be provided with time to modify their present units in light of their learning and to share their modified units with other teachers.

Biology for the Next Generation

This 5-day course will continue the vertical articulation of rigor in academic skills and scientific practices, to fully prepare BSD students so that they are career and college ready. This course will teach teachers how to incorporate patterns, data analysis, inquiry, and engineering into the junior-level biology course. In this active hands-on class, teachers will be shown how to increase rigor and student engagement in Biology through the use large real-time data bases for authentic inquiry, case studies, using common core literacy standards to address scientific argumentation, simulations, satellite imagery (GIS), technology, and math rigor.

Middle School Science Professional Development Courses

The Beaverton School District is providing professional development to support middle school science in engineering practices that are an important part of ODE science standards and the soon to be released Next Generation Science Standards. In an effort to continue progress in this area, Middle School teachers will be required to take one of the two science courses listed below. The 2-day Freshman Physics course will cover the expectations BSD has for all 9th graders. The engineering course for MS teachers will have optional follow-up PD sessions that will be held during the 2013-2014 school year.

Purpose of Requiring Science Professional Development Courses

- It allows the district to address specific issues within core instructional areas that have been identified as problematic. For example, student scores on the science portion of the ACT and OAKS Science Assessment were the lowest of all the core instructional areas.
- BSD goals of equity were not being met in science. Demographic factors could be used as predictors of success in past science courses and as predictors of the level of the rigor of science course sequences that students took.
- Results from the STEM Physics summer training in 2012 and ongoing monthly support has shown that this model works in changing teaching practices and building a collaborative environment for teacher learning
- The need to develop a cohesive 6-12 science sequence that builds rigor and focuses on inquiry, engineering, critical thinking and problem solving

Course Info

- Teachers choose either a school year option or a summer option.
- Teachers will be paid per diem for summer courses. Teachers enrolled in the April/May course will be provided a sub
- Any MS teacher may take the two- day Physics course. It is strongly recommended for 8th grade science teachers
- There will be optional follow up meetings throughout the school year
- Registration Period: **April 5th - April 19th**
- Register at TeacherSource

Science Professional Development Course Schedule - Middle School

Title	Dates	Time
Increasing STEM in Physics	May 29 & June 3	8:00 – 3:00
MS Engineering	August 13	8:00 – 3:00
MS Engineering	October 1	8:00 – 3:00

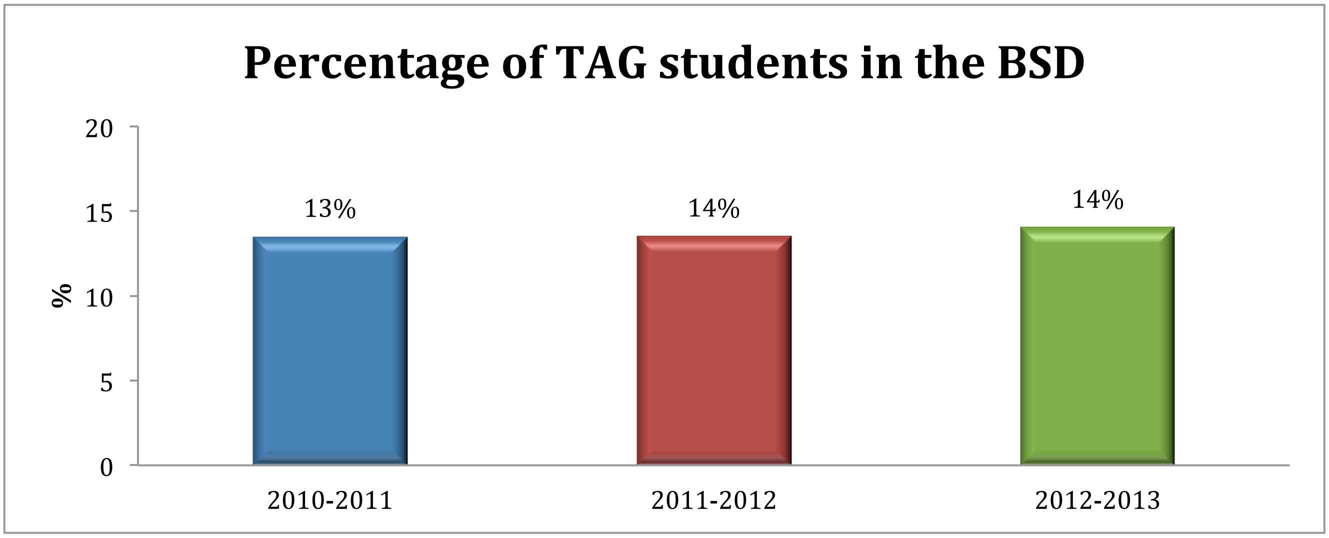
MS Science Professional Development Course Descriptions

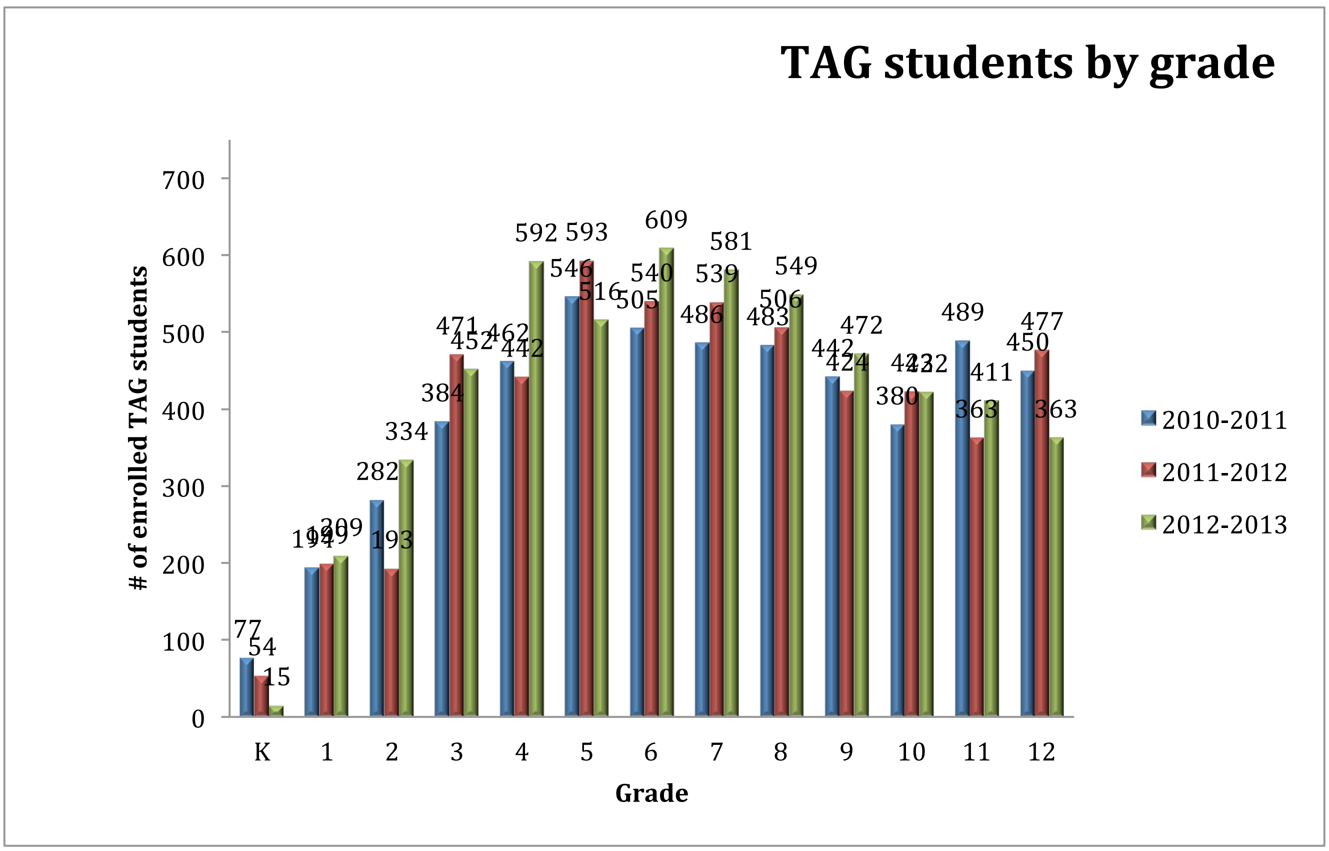
Increasing STEM in Physics

This course will specifically focus on implementing an inquiry-based curriculum that explicitly addresses the Science, Technology, Engineering, and Math (STEM) standards as laid out in the Oregon State Standards, the Common Core State Standards for Mathematics, and the Next Generation Scientific Practices and Cross Cutting Concepts. Teachers will learn how to guide students to proficiency through rigorous, experiential learning activities. This will primarily be achieved through teachers participating in guided instruction. Focus is on incorporating math rigor and inquiry and engineering practices as a primary mode of learning Physics. Four patterns seen in Physics are introduced as a major component of the course. Teachers will learn how to incorporate student discussion and learning through "Board Discussions". Teachers who attend this course, may also attend the year-long follow-up sessions on engineering.

MS Engineering

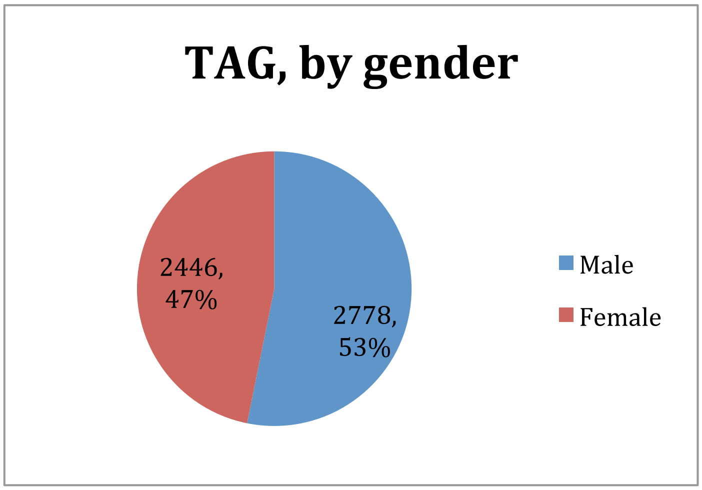
This course will utilize training provided by an ODE engineering grant. Ties to BSD learning targets will be made. Teachers will learn how to incorporate high quality engineering practices into their core instruction, helping students meet the Next Generation Science Standards. Materials for grade level engineering activities learned in the PD will be purchased using grant funds and provided to teachers. Follow-up sessions during the 2013-2014 school year will allow teachers to continue their learning on the integration of engineering and Next Generation Science Practices into their classroom.

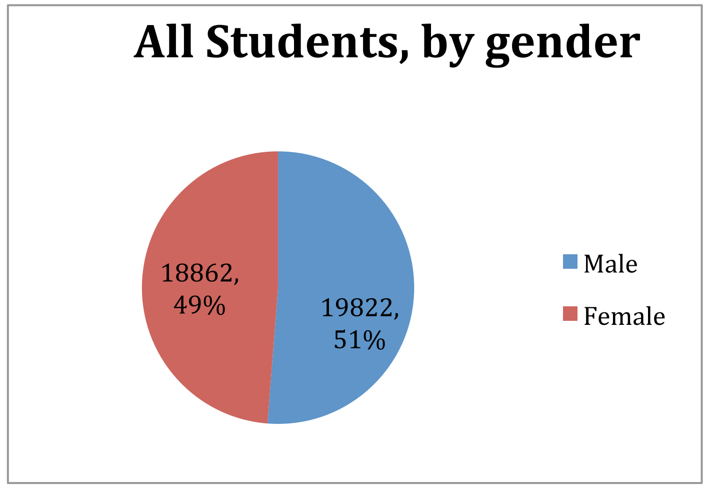


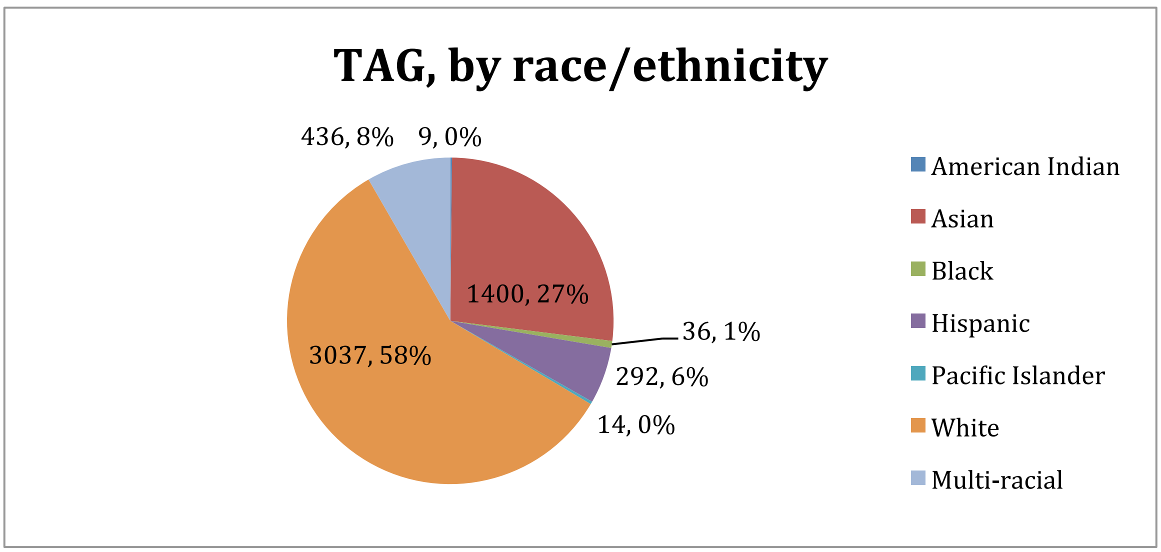


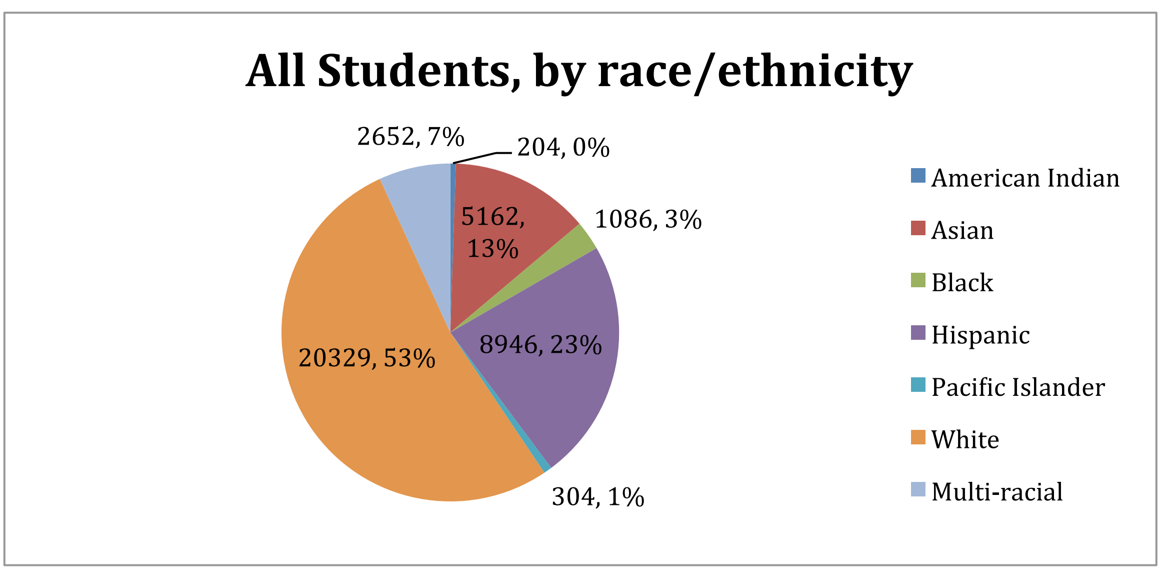
Year	K	1	2	3	4	5	6	7	8	9	10	11	12
2010-2011	77	194	282	384	462	546	505	486	483	442	380	489	450
2011-2012	54	199	193	471	442	593	540	539	506	424	423	363	477

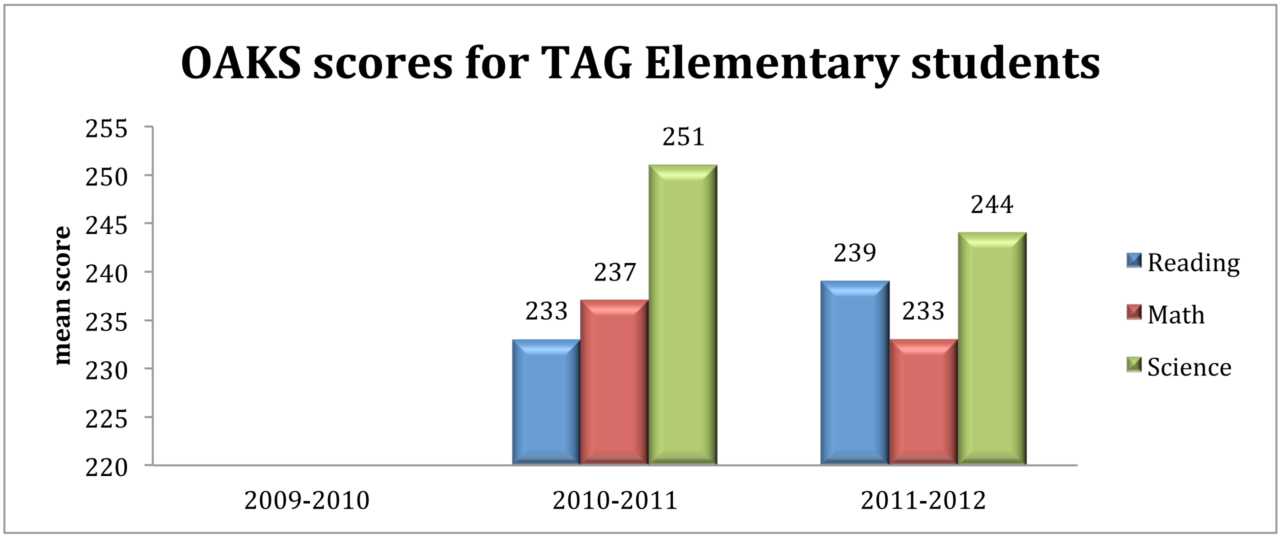
2012-2013	15	209	334	452	592	516	609	581	549	472	422	411	363

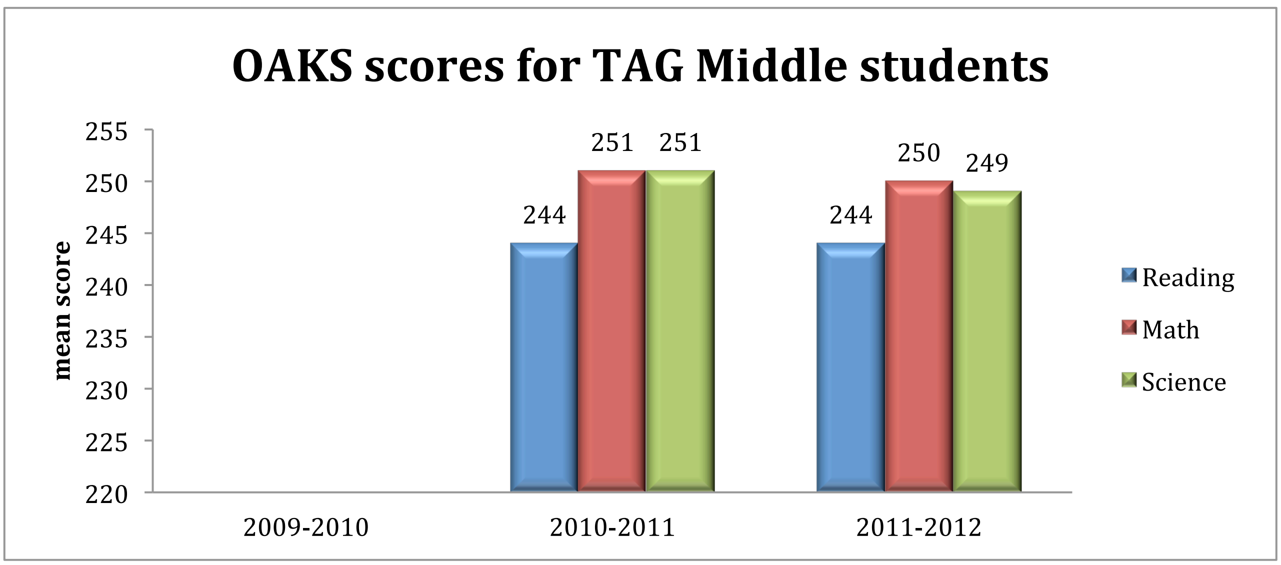


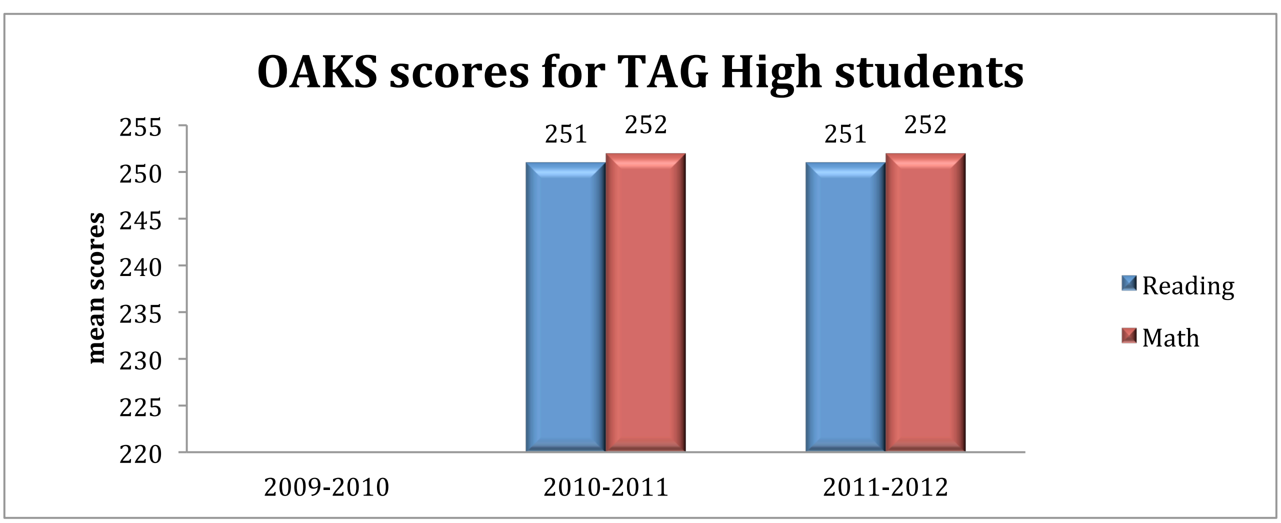


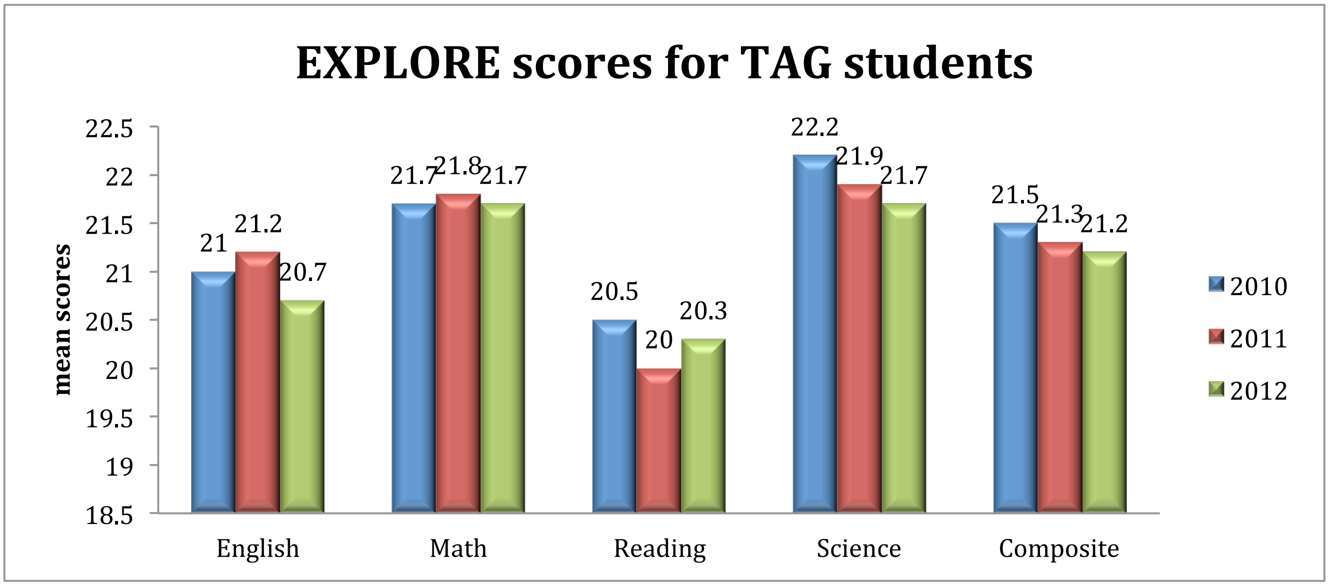


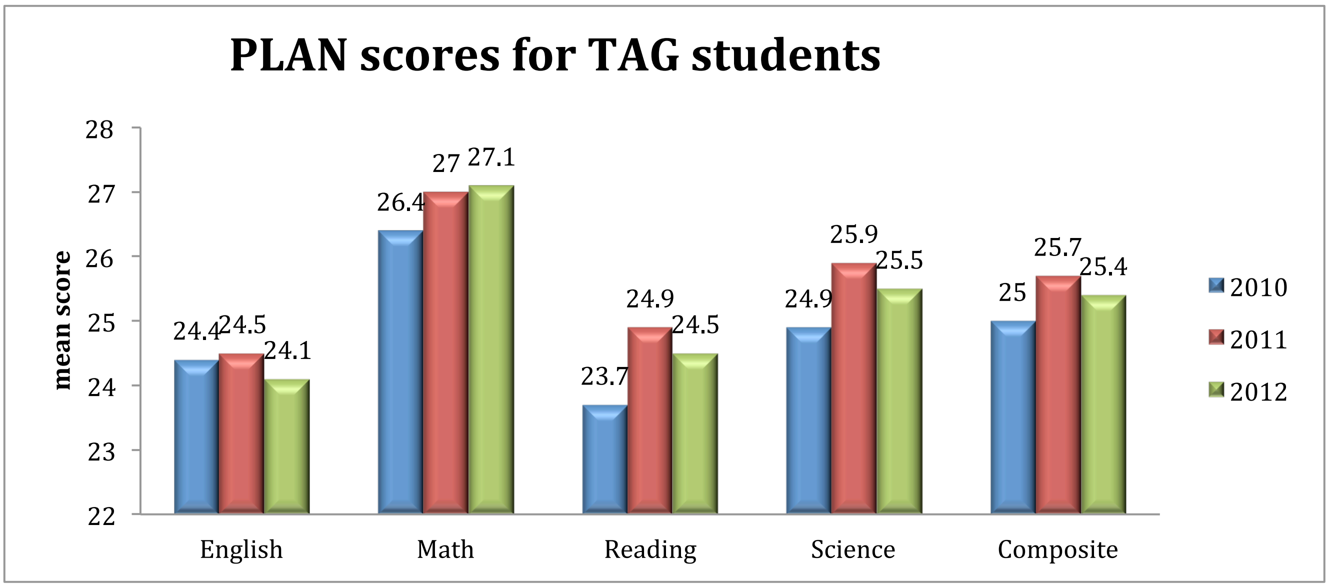


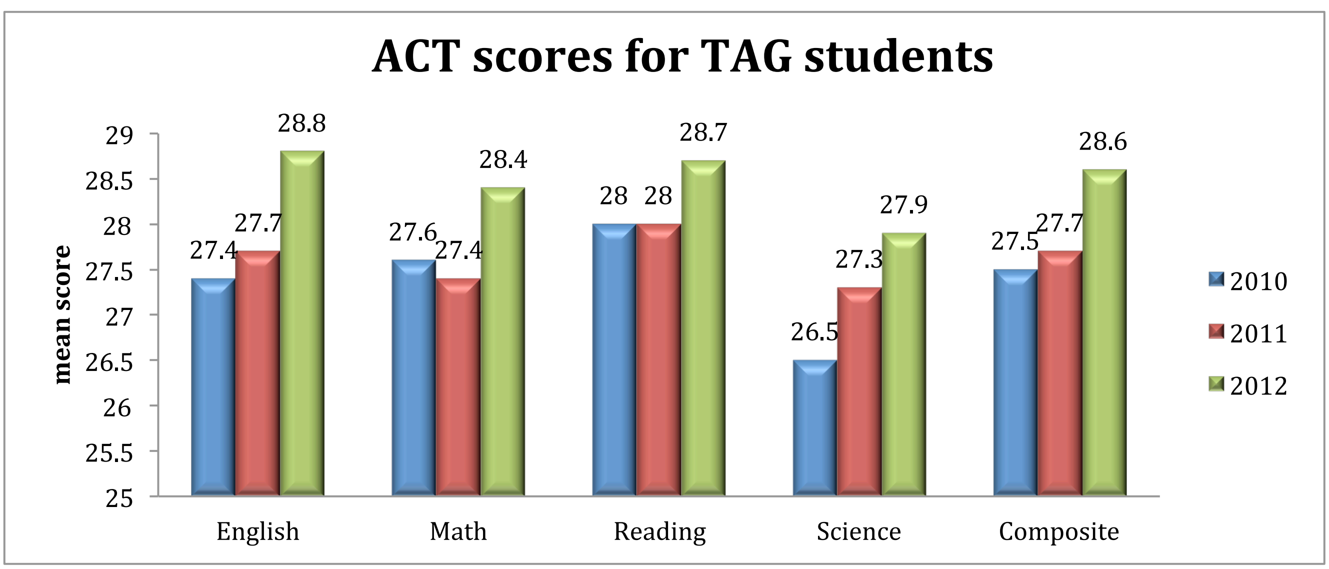

OAKS scores for TAG Elementary students
mean score
255
250
245
240
235
230
225
220
233
237
251
239
233
244
2009-2010
2010-2011
2011-2012
Reading
Math
Science

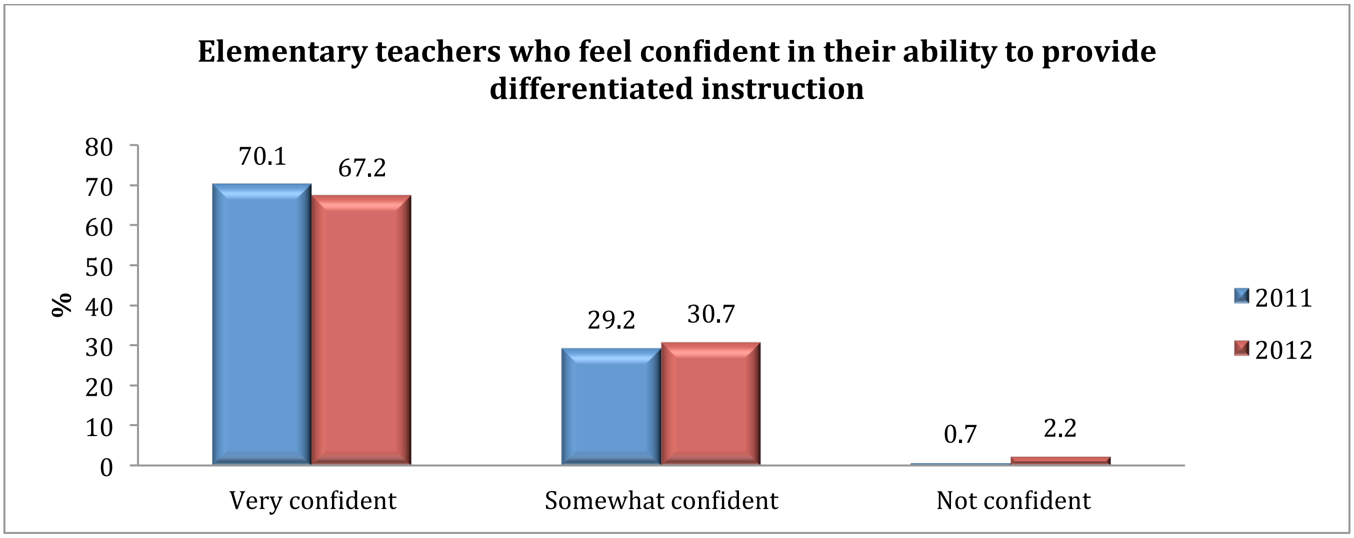

OAKS scores for TAG Middle students
mean score
255
250
245
240
235
230
225
220
244
251
251
244
250
249
2009-2010
2010-2011
2011-2012
Reading
Math
Science

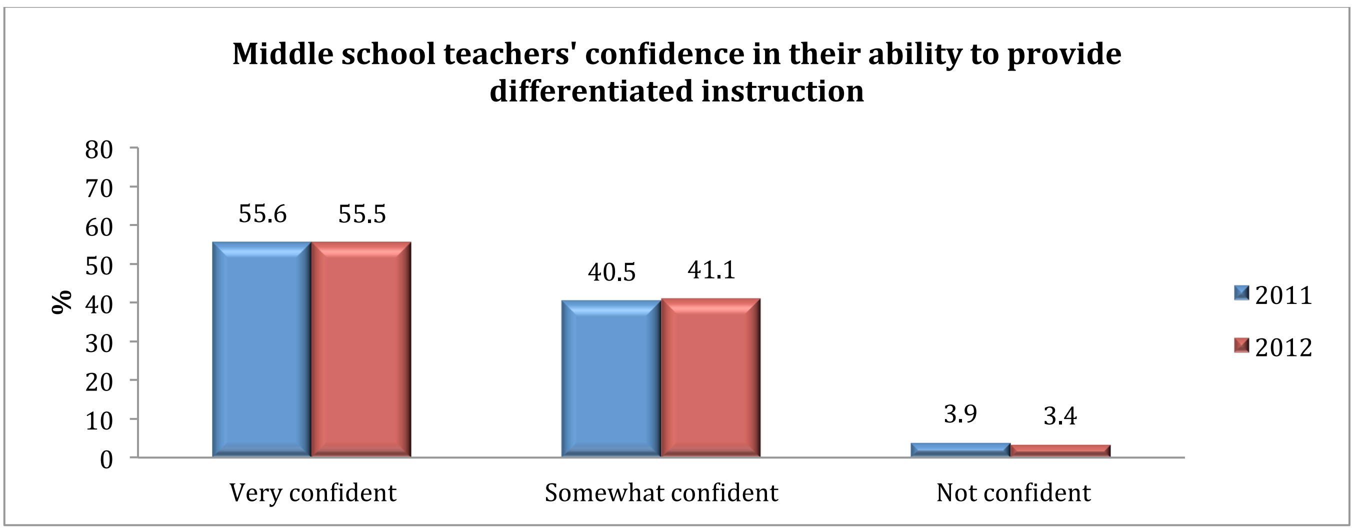

OAKS scores for TAG High students
mean scores
255
250
245
240
235
230
225
220
251
252
251
252
2009-2010
2010-2011
2011-2012
Reading
Math

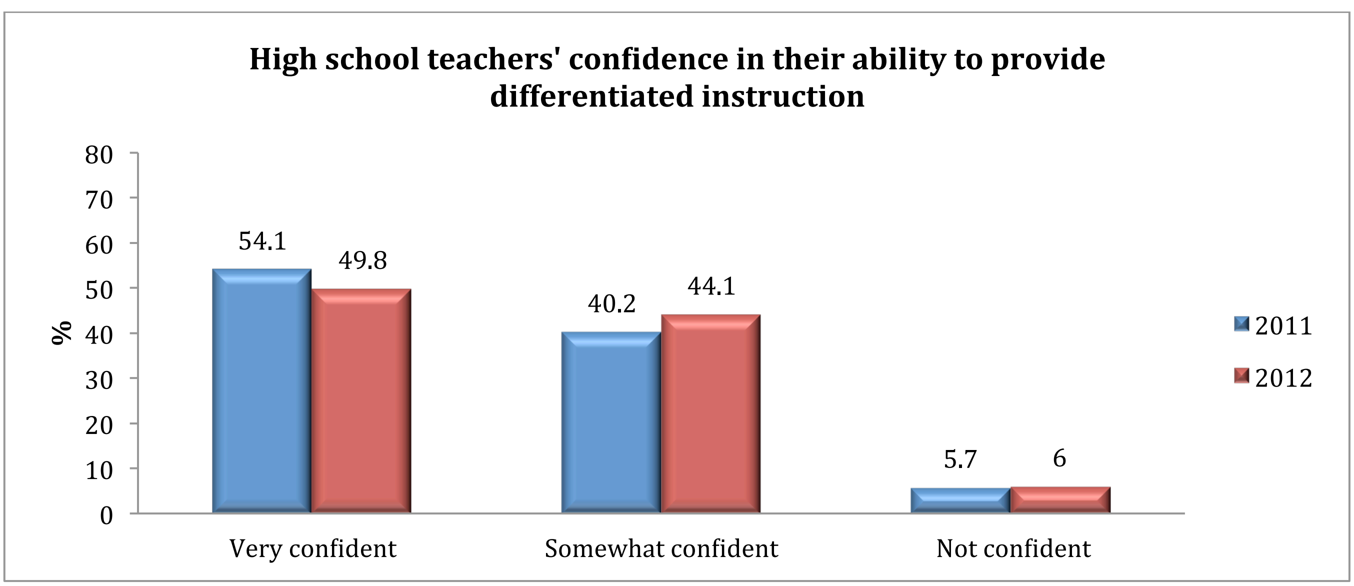

EXPLORE scores for TAG students
mean scores
22.5
22
21.5
21
20.5
20
19.5
19
18.5
21
21.2
20.7
21.7
21.8
21.7
20.5
20
20.3
22.2
21.9
21.7
21.5
21.3
21.2
English
Math
Reading
Science
Composite
2010
2011
2012


PLAN scores for TAG students
mean score
28
27
26
25
24
23
22
24.4
24.5
24.1
26.4
27
27.1
23.7
24.9
24.5
24.9
25.9
25.5
25
25.7
25.4
English
Math
Reading
Science
Composite
2010
2011
2012


ACT scores for TAG students
mean score
29
28.5
28
27.5
27
26.5
26
25.5
25
27.4
27.7
28.8
27.6
27.4
28.4
28
28
28.7
26.5
27.3
27.9
27.5
27.7
28.6
English
Math
Reading
Science
Composite
2010
2011
2012


Elementary teachers who feel confident in their ability to provide differentiated instruction
%
80
70
60
50
40
30
20
10
0
70.1
67.2
29.2
30.7
0.7
2.2
Very confident
Somewhat confident
Not confident
2011
2012


Middle school teachers' confidence in their ability to provide differentiated instruction
%
80
70
60
50
40
30
20
10
0
55.6
55.5
40.5
41.1
3.9
3.4
Very confident
Somewhat confident
Not confident
2011
2012


High school teachers' confidence in their ability to provide differentiated instruction
%
80
70
60
50
40
30
20
10
0
54.1
49.8
40.2
44.1
5.7
6
Very confident
Somewhat confident
Not confident
2011
2012

Davidson Institute for Talent Development

Curriculum for Highly Able Learners That Conforms to General Education and Gifted Education Quality Indicators

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Curriculum for Highly Able Learners That Conforms to General Education and Gifted Education Quality Indicators

Legislative measures designed to ensure that all students meet minimal expectations have concerned leaders in gifted education. In this current educational climate of standards and accountability, however, there is arguably greater agreement than ever before between experts and professional organizations in general education and their counterparts in gifted education on what constitutes high-quality curriculum. Toward demonstrating that many groups of learners, gifted among them, stand to benefit from the consensus, this paper (a) synthesizes guidance from curricular voices in both fields; (b) evaluates the viability of 3 gifted education curriculum models—the Integrated Curriculum Model (VanTassel-Baska, 1986), the Multiple Menu Model (Renzulli, 1988) and the Parallel Curriculum Model (Tomlinson et al., 2002)—to conform to these guidelines and contribute to exemplary curriculum design for all learners, including those who are highly able; and (c) offers suggestions for how general education and gifted education can create curricular conditions conducive to educating highly able learners well.

Introduction

Educational leaders with a particular interest in highly able learners have expressed concern about aspects of the standards movement as envisioned and enforced by the No Child Left Behind (NCLB) Act of 2001. They maintain that the legislated focus on minimum expectations and test-driven curriculum and instruction is a potential threat to national security (Gallagher, 2005), the future of research and development in the United States (Renzulli, 2005), programs for gifted students (Brown, Avery, VanTassel-Baska, Worley, & Stambaugh, 2006; Reis, 2007), and high-quality education for all students, including those who are gifted (Clarenbach, 2007; Gentry, 2006; Tomlinson, 2002).

One goal of NCLB (2001) is to ensure that all children have access to a rigorous curriculum. However, rather than prompting provisions and modifications for all learners, including those identified as gifted and talented, state accountability systems have influenced some teachers to emphasize uniformly delivered test preparation lessons at the expense of differentiated approaches to curriculum and instruction (Abrams, Pedulla, & Madaus, 2003; Brown et al., 2006; Moon, Brighton, & Callahan, 2003) and to focus their efforts on students who are most likely to pass state tests if provided additional and individualized instruction (Booher-Jennings, 2005). Undoubtedly, the quality of general education and gifted program curriculum is at risk in an educational climate concerned primarily with minimal competency.

Despite numerous well-founded concerns about how various groups of learners are and will be affected by this narrow focus, the recent shift toward standardization has not been categorically deleterious for curriculum. Some experts have developed exemplary models of how curriculum can be aligned with standards yet maintain fidelity to research and best practices (e.g., Erickson, 2002; Wiggins & McTighe, 1998). Although the prevailing means of obtaining and interpreting student progress and school quality are questionable, school districts having to account for some groups of learners they may have previously overlooked or disregarded lays the philosophical groundwork for overhauling curriculum at the local level.

Curriculum leaders oriented in gifted education, then, have an opportunity in this critical time to influence curriculum development. The purpose of this paper is to demonstrate the alignment between what general education and gifted education experts and professional organizations say constitutes high-quality curriculum and to investigate the potential of three gifted education curriculum models for designing curriculum that is exemplary for all learners, including those who are advanced. In a broader sense, this paper examines how ready the overall existing curricular climate is for designing curriculum for gifted learners, as well as for all learners, that adheres to high standards of quality by answering the following questions:

1. What are the indicators of high-quality curriculum as articulated by key general education curriculum experts and organizations and by key gifted education curriculumexperts and organizations, and what overlap and distinctions exist between these two groups' perspectives on highquality curriculum?
2. What is the potential of three gifted education curriculum models (i.e., Integrated Curriculum Model, Multiple Menu Model, Parallel Curriculum Model) to contribute to quality curriculum for general education as well as to address the needs of highly able learners?
3. In what areas must general education curriculum and gifted education curriculum, respectively, improve in order to meet the needs of highly able learners?

The perspectives in this review were selected for their notable presence in and influence on curriculum literature from general education and gifted education. They are intended to be representative rather than exhaustive. The syntheses that follow are the results of inductive analyses of articles, position statements, standards documents, research reports, and theoretical and practical curriculum models.

Consensus About High-Quality General Education Curriculum

Debate over the American school curriculum has persisted since the late 19th century (Kliebard, 2004). The curriculum reform movement proper can be traced to the years following World War II. Military recruiting had revealed that many U.S. high school graduates lacked adequate mastery of important math and science concepts. The advent of Sputnik in 1957 reinforced fears that the quality of American curriculum was in need of improvement, especially if the nation were going to be globally competitive (Goodlad, 1964).

The "standards movement" in particular emerged in the early 1980s, partially in response to perceptions that a well-articulated curriculum, an emphasis on academic subjects, and a focus on educational outcomes were missing from U.S. schools (Marzano, Kendall, & Gaddy, 1999). The National Council of Teachers of Mathematics' (NCTM) publication of the *Curriculum and Evaluation Standardsfor School Mathematics* in 1989—a consensus document on what students should know and be able to do—prompted professional organizations to join the effort to delineate curriculum standards (Kendall & Marzano, 2004). By the mid-1990s, in addition to discussions over what should be taught in curriculum and how, state and national leaders were focusing on benchmarks according to which student progress with the curriculum could be assessed.

It might be argued that the assessment aspect of the standards movement has sparked fruitful discussion in general education about the quality and appropriateness of curriculum for various subgroups of students, including students who are highly able. At the very least, there is a current, well-articulated body of theoretical and researchbased advice from curriculum experts on what constitutes high-quality curriculum for all students. Seven principles synthesize common areas of agreement among key general education curriculum experts and professional organizations.

Principle 1: High-Quality General Education Curriculum Uses Concepts in Its Design, Organization, and Implementation

Using concepts to organize curriculum is a widely advocated practice in general education. Whether using the term concepts explicitly (Erickson, 2002) or other terms like focal points (NCTM, 2006), foundational ideas and conceptual understanding (NCTM, 2000), core ideas (Board on Science Education [BOSE] & Center for Education [CFE], 2007), themes (Geography Education Standards Project [GESP], 1994), unifying concepts and processes (National Research Council [NRC], 1996), or topical organization (National Center for History in the Schools [NCHS], 1996), the idea of identifying lenses through which the curriculum can be arranged pervades general education perspectives. Erickson defined a concept as "a mental construct, an organizing idea that categorizes a variety of examples" (p. 56). It is timeless, universal, abstract, and broad. The National Science Education Standards (NRC, 1996), for example, are classified according to four clusters of concepts: system, order, and organization; evidence, models, and explanation; change, consistency, and measurement; and form and function. These organize the understandings and processes that students need to develop over the course of their education.

There are numerous reasons cited for taking a concept-based approach to organizing curriculum. Concepts bring coherence to curriculum, facilitate the development of expertise, and are vehicles for thinking in the ways of a discipline (NCTM, 2006; NRC, 1998). They assist the learner in examining the nature of a subject, in making intra- and interdisciplinary connections, and in seeing patterns (Bruner, 1960; Erickson, 2002; NCTM, 2000). Integrating concepts into curriculum also expedites learning new knowledge by helping students connect new knowledge with old knowledge, transfer understandings to new situations, and retrieve previously learned knowledge quickly (Erickson, 2002; NCTM, 2000; NRC, 1998; Taba 1962).

Principle 2: High-Quality General Education Curriculum Should Be Rooted in Ideas, Principles, and Skills Essential to the Respective Disciplines

Bruner (1960) asserted, " . . . any subject can be taught effectively in some intellectually honest form to any child at any age of development" (p. 33). Contemporary curriculum experts share this conviction with their emphasis on discipline-based content and processes. When curriculum has a discipline-based orientation, it maintains fidelity to the discipline, selects content that is fundamental and enduring within and beyond the discipline, and employs processes authentic to the discipline.

The starting point for selecting high-quality curricular content is the disciplines themselves. Although enough subject-matter details to allow students to build a foundation for further learning should be included, the curriculum itself should emphasize knowledge as a whole and be organized around a few core ideas at the heart of the discipline (BOSE & CFE, 2007; NRC, 1998; Taba, 1962; Wiggins & McTighe, 1998). To facilitate transfer of learning, create student interest, and aid retrieval, the organizing principles and structure of the discipline should be stressed (Bruner, 1960; National Council of Teachers of English [NCTE] & International Reading Association [IRA], 2000; NRC, 1998). In addition to principles of the discipline, high-quality curriculum includes important facts, concepts, laws, generalizations, theories, and models (Erickson, 2002; NRC, 1996). Any changes in the discipline (e.g., improvements, new research, new ways of thinking and doing) warrant corresponding changes in the curriculum (NCTM, 2000).

Discipline-oriented curricular content also must be fundamental and enduring. Taken together, the national science and mathematics standards documents suggest that topics and content have importance and staying power if they are useful in developing ideas and connecting areas across the discipline, are representative of events or phenomena in the natural world, are valuable for solving problems within or beyond the discipline, are applicable to everyday situations and contexts, guide worthwhile investigations, and are beneficial in deepening students' appreciation for the discipline (NCTM, 2000; NRC, 1996). Wiggins and McTighe (1998) took a similar view. According to their criteria, content that is enduring (a) lies at the core of the discipline, (b) has lasting importance and meaning beyond the classroom, (c) reveals abstract or frequently misunderstood ideas, and (d) offers promise for engaging students. Bruner (1960) echoed the importance of curriculum fortitude, albeit more simply:

We might ask, as a criterion for any subject taught in primary school, whether, when fully developed, it is worth an adult's knowing, and whether having known it makes a person a better adult. If the answer to both questions is negative or ambiguous, then the material is cluttering the curriculum. (p. 52)

Finally, curriculum with a discipline orientation teaches students to think and act like practicing professionals through processes that are true either to specific disciplines or to research and scholarship skills that are applicable across domains (Erickson, 2002; NCHS, 1996; NCTM, 2000; National Council for the Social Studies [NCSS], 1994; National Middle School Association [NMSA], 1995; NRC, 1996). According to Erickson (2002), "If we can teach children to think and perform like scientists, artists, and so on, then we are giving them valuable process abilities to apply in a multidimensional world" (p. 95). Curriculum that allows students to develop the habits and skills of professionals leads them through specific, authentic processes that approximate the conditions, problems, and questions faced by those who work in the discipline every day (GESP, 1994; NCHS, 1996; NCTM, 2000; NCSS, 1994; NRC, 1996).

Principle 3: High-Quality General Education Curriculum Is Flexible in Response to Student Differences

That students differ from one another is recognized by nearly all professional organization curriculum documents. Noted differences include variation in learning style, concept acquisition, readiness relative to a standard, cultural background, talents, abilities, achievements, needs, and subject-matter interest (GESP, 1994; National Association for the Education of Young Children [NAEYC], 2003; NCTE & IRA, 2000; NCTM, 2006; NMSA, 1995; NRC, 1999).

This variance among students requires that curriculum be flexible enough for teachers to make adjustments. A recent science education report warns that these modifications do not imply "dumbing down" curriculum and instruction; rather, they require building on basic reasoning skills, personal knowledge, and natural curiosities to help students attain proficiency (BOSE & CFE, 2007). Teachers use preassessment and ongoing assessment to determine what students already know—including their prior knowledge, beliefs, experiences, and preconceptions —and use these understandings as entry points for instruction (BOSE & CFE, 2007; Bruner, 1966; Dewey, 1938; NRC, 1998; Solomon, 1998).

Regardless of individual student differences, a high degree of challenge and high expectations should be in place for all learners (NAEYC, 2003; NCTM, 2000; NMSA, 1995). Tasks ought to be achievable and give students satisfaction, even if they perceive them as difficult (NMSA, 1995; Tyler, 1969). The curriculum allows students to simultaneously strengthen high-skill areas and develop areas of weakness (Solomon, 1998). Supports for students with disabilities or who otherwise struggle with a certain aspect of school should be in place, as should modifications for students who demonstrate unusual interest or exceptional talent in a subject (NCTM, 2000; NMSA, 1995).

A curriculum flexible enough to respond to student differences is also developmentally appropriate. Standards, curriculum, and assessment should reflect the most recent research findings about the thinking and capabilities of children. For example, because research has shown that children are more capable at a younger age than previously thought, curriculum in the primary grades may need to be more challenging (BOSE & CFE, 2007; NAEYC, 2003). Far from being an exclusively contemporary curricular concern, historic voices also have stressed developmental appropriateness of curriculum, particularly in presenting subject matter or the structure of the discipline in ways that are authentic, yet accessible to the student (Bruner, 1960; Dewey, 1938).

Principle 4: High-Quality General Education Curriculum Moves Students Toward Expertise by Promoting Discipline-Based Skills and Cognitive and Metacognitive Processes Associated With Expertise, and Progressively Developing Expertise Across Grade Levels

Dewey (1916) called keeping students moving toward the direction of what the expert knows "the problem of teaching" (p. 216)—one that requires the teacher to know both the subject and the students deeply. The NRC (1998) conceived the goal of schooling in general as "moving students in the direction of more formal training (or greater expertise)" (p. 13). Their extensive synthesis of research on expertise concludes that, compared to novices, experts are better able to recognize patterns, approach problems in terms of core concepts or big ideas, use selective retrieval of information, spend more time defining a problem when solving one, and have stronger metacognitive skills (NRC, 1998). Development of expertise requires a deep store of knowledge as well as a conceptual framework for the subject matter (NRC, 1998).

Curriculum designed for nurturing expertise has several characteristics. It helps learners become increasingly independent through the use of challenging tasks (NCTM, 2000). It equips students with discipline-relevant knowledge and understanding (Erickson, 2002; NRC, 1998) and employs authentic materials and methods to create products (BOSE & CFE, 2007). In science, for example, students should not only conduct experiments but also examine scientific work that uses observational methods, historical reconstructions and analyses, and other nonexperimental methods (BOSE & CFE, 2007). Curriculum that leads students toward expertise also integrates the teaching of metacognitive skills in all subject areas (NRC,1998). There are opportunities for students to reflect and self-evaluate through reading, thinking, discussing, and writing (NCSS, 1994; NMSA, 1995).

Because the development of expertise is an ongoing process, high-quality curriculum allows students to develop understanding, knowledge, and skills progressively. Therefore, the articulation of curricular scope and sequence across grades K–12 must provide consistency and continuity (English, 2000). Ideas and concepts are revisited, leading toward deepened, more complex, more refined, and increasingly sophisticated levels of understanding (BOSE & CFE, 2007; Bruner, 1960; Erickson, 2002; NCTM, 2000; NRC, 1996, 1998; Tyler, 1969; Wiggins & McTighe, 1998).

Principle 5: High-Quality General Education Curriculum Should Emphasize Student Outcomes, in Particular, the Goal of Deep Understanding

Well-organized, focused curriculum is driven by student outcomes; that is, it begins with the end in mind (English, 2000; Erickson, 2002; NRC, 1999; Wiggins & McTighe, 1998). Such a "backward design" approach identifies desired outcomes, decides what evidence of student mastery looks like, and plans learning experiences and instruction that match curricular goals (Wiggins & McTighe, 1998).

The NCTM (2000) observed, "Learning without understanding has been a persistent problem since the 1930s" (p. 20). Far from equating understanding with fact recall and basic skills, curriculum experts and professional organizations define understanding as a complex, multifaceted construct, and maintain that all learning outcomes should be centered on the goal of deep understanding. Understanding involves both concrete and abstract information and ideas (Erickson, 2002; Wiggins & McTighe, 1998). When students truly understand, they (a) grasp the underlying theories, principles, processes, attitudes, and beliefs in an academic discipline; (b) can apply what they learn; (c) can transfer their understanding to familiar and unfamiliar contexts; and (d) integrate many types of knowledge (Center for Civic Education [CCE], 1994; NCHS, 1996; NCSS, 1994; NCTE & IRA, 2000; NRC, 1996, 1998; Wiggins & McTighe, 1998).

Wiggins and McTighe (1998) asserted that understanding has six facets: explanation, interpretation, application, perspective, empathy, and self-knowledge. Because each facet exists on a continuum from novice to expert, assessing student understanding should pinpoint where students are on those continua.

Principle 6: High-Quality General Education Curriculum Should Be Relevant and Engaging to Students

Relevance and engagement in the curriculum are two related, yet distinct characteristics of high-quality curriculum. Both require meaningful connections between the student and what he or she is learning; however, relevance refers to the proximity of the connection and engagement to the duration and degree of the connection.

For curriculum to be relevant, students must see and understand how it connects to their own lives—what they have learned and experienced both in and outside of school—as well as to its importance for their futures in specific fields and as participating citizens (Beane, 1997; CCE, 1994; NCTM, 2000; NCSS, 1994; NMSA, 1995). Relevance can likewise involve connections to daily life, realworld concerns, current events, and community interests that are significant to students and adults (Dewey, 1916; GESP, 1994; NCSS, 1994; NMSA, 1995; NRC, 1999; Quigley, 2005; Tyler, 1969).

High-quality curriculum is also engaging (Dewey, 1916, 1938; NAEYC, 2003; Solomon, 1998; Tyler, 1969). To ensure engagement, experts broadly suggest giving students choice, capitalizing on student interests, and using active learning strategies (Beane, 1997; CCE, 1994; NAEYC, 2003; NCTM, 2000; NMSA, 1995; Solomon, 1998). Four more specific ways proposed to increase student engagement in the curriculum are through the uses of exploratory curriculum, inquiry learning, essential questions, and/or authentic problem solving.

The NMSA (1995) is one proponent of an approach to curriculum that allows students to explore their interests, abilities, values, talents, and preferences. A wide range of elective courses is offered, but curriculum across all subject areas should maintain an exploratory approach.

Inquiry learning is another way to foster student engagement with the curriculum. As students use inquiry to wrestle with different ideas and realities, they are no longer "passive knowledge-receivers" but "active constructors of meaning" (Wiggins & McTighe, 1998, p. 11). The National Science Education Standards (NRC, 1996) promote inquiry as an important part of curriculum, citing its capacity to aid in understanding scientific concepts and the nature of science; develop an appreciation of scientific knowledge; and acquire dispositions for using the skills, abilities, and attitudes associated with science. Similarly, the National Geography Standards (GESP, 1994) advocate leading students through a process of geographic inquiry to help them integrate geographic skills and the ability to think geographically.

One driving force behind student inquiry—as well as behind engaging, relevant curriculum—is essential questions. Related to engagement, essential questions are constructed to evoke and sustain student interest and facilitate learning by discovery (Erickson, 2002; Wiggins & McTighe, 1998). They allow the student to simulate the inquiry that originally yielded the knowledge (Wiggins & McTighe, 1998). In other words, through essential questions, students see that we know what we know because someone somewhere asked the necessary questions and pursued the answers. In recreating the process, students build conceptual understanding, discover patterns, and build personal meaning (Erickson, 2002).

To increase the likelihood of engagement, inquiry driven by essential questions should be directed toward solving real problems. These should be problems that approximate conditions or situations in which the problem would arise naturally (Tyler, 1969). Ideally, the problems are similar to those the student has previously encountered in his or her own life and are student generated (Dewey, 1916).

Principle 7: High-Quality General Education Curriculum Should Be Integrative and Maintain a Balance Between Breadth and Depth

Few experts, if any, condone teaching subjects as isolated entities. Likewise, few see curricular breadth and depth as an either/or proposition between which teachers and curriculum writers must choose. Some degree of integration and balance between breadth and depth are common among definitions of high-quality curriculum.

At its core, integration allows students to see how ideas build on and relate to one another, form patterns and connections at a conceptual level, and construct an integrated whole (Erickson, 2002; NCTM, 2000). Although the terms integration and integrated are widely and variably used in curriculum literature, two uses are most common. First, integrative can refer to connections within and across disciplines. Curriculum that is interdisciplinary will integrate topics, concepts, skills, and knowledge from different content standards, different school subjects (e.g., science and history), as well as different areas of intellectual and social life (NCHS, 1996; NCSS, 1994; NMSA, 1995; NRC, 1996). Intradisciplinary connections in curriculum show relationships between or within different subject-matter area knowledge, principles, and skills (NCSS, 1994; NCTE & IRA, 2000; NRC, 1996).

A second view regards integration as more central to curriculum design. Beane (1997), for example, defined curriculum integration as "a curriculum design that promotes personal and social integration through the organization of curriculum around significant problems and issues" (pp. x–xi). The teacher and students identify these problems and issues together without considering subject-area boundaries (Beane, 1997).

In its effort to be integrative, curriculum must maintain a balance between breadth and depth. Wiggins and McTighe (1998) defined breadth as getting below a topic's surface, and depth as "the extensions, variety, and connections needed to relate disparate facts and ideas" and bring power to learning (p. 101). American curriculum typically includes more topics than can be taught well (e.g., Schmidt, 1997). So, rather than "cover" the curriculum on a superficial level, students should "uncover" it (Wiggins & McTighe, 1998). The curriculum should address fewer topics and focus on powerful ideas in order to better illuminate concepts (BOSE & CFE, 2007; NCTM, 2006; NCSS, 1994; NRC, 1996, 1999). Depth in at least some areas is necessary "so that the content has a better chance to be meaningful, organized, linked firmly to children's other ideas, and to produce insight and intuition rather than rote performance" (Schmidt, 1997, p. 140).

Consensus About High-Quality Gifted Education Curriculum

For nearly 50 years, the field of gifted education has sought to distinguish what makes curriculum for highly able

For nearly 30 years, the field of gifted education has sought to distinguish what makes curriculum for highly able learners "qualitatively different" from curriculum that is beneficial for all learners. More recently, key experts in the field have tried to explicate more precisely the nature of curriculum that is advanced and challenging—two generic terms often used in describing modifications for gifted learners. Few gifted education leaders would disagree that all students, regardless of their abilities, require sufficiently demanding curriculum that increases in sophistication as individual readiness progresses. Describing and illustrating hallmarks of challenging, advanced work specific to gifted learners, however, has proven a difficult theoretical task of making distinctions, both subtle and apparent. Five principles of high-quality curriculum represent areas of agreement among key curriculum experts in gifted education.

Principle 1: High-Quality Curriculum for Gifted Learners Uses a Conceptual Approach to Organize or Explore Content That Is Discipline Based and Integrative

Experts in gifted education advocate a conceptual orientation to organize curriculum that is discipline based and integrative (Feldhusen, 1985; Hayes-Jacobs & Borland, 1986; Kaplan, 1974; Maker & Nielson, 1996; Renzulli, Leppien, & Hays, 2000; Shore, Cornell, Robinson, & Ward, 1991; Tomlinson et al., 2002; VanTassel-Baska, 1998). Curriculum with a discipline-based foundation uses the principles, skills, theories, ideas, and values most essential to a field of study to illuminate the nature of the discipline itself (Feldhusen, 1985; Maker, 1986; Passow, 1982; Renzulli et al., 2000; Tomlinson et al., 2002; Ward, 1980). The structure of the discipline itself informs how the curriculum is arranged (VanTassel-Baska, 1989); students should be able to see where the discipline "fits" within the larger body of knowledge and from where it originates (Renzulli et al., 2000; Ward, 1980).

Curriculum that is integrative concentrates on the relationships between bodies of knowledge; presents content related to broad- based issues and themes; focuses on cross-disciplinary concepts; and exposes students to multiple perspectives and domains of inquiry (Kaplan, 1979; Maker, 1986; Passow, 1982; VanTassel-Baska, 1989, 1998). Integration allows the learner to apply knowledge at multiple levels, transfer knowledge within and across disciplines, see patterns and connections within and across disciplines, and understand a discipline's depth and complexity (Hayes-Jacobs & Borland, 1986; Kaplan, 1979; Passow, 1982; Rogers, 2002; Tomlinson, 2005).

Principle 2: High-Quality Curriculum for Gifted Learners Pursues Advanced Levels of Understanding Beyond the General Education Curriculum Through Abstraction, Depth, Breadth, and Complexity

Because learners who are highly able are presumed to be more cognitively advanced than their peers, it follows that curriculum should help them develop understandings commensurate with their abilities. Many gifted education curriculum experts conclude that general education curriculum is not designed to accommodate the development of advanced understanding, and therefore, adjustments through abstraction, depth, breadth, and complexity are necessary.

Abstraction involves content, processes, and products that are more removed from or less familiar to students' experiences (Maker & Nielson, 1996). Students may work with the implications and extensions of ideas rather than concrete examples and illustrations (Tomlinson, 1997). Symbolism and the underlying meaning of content are stressed (Rogers, 2002), as are formulating theories, examining the philosophical underpinnings of disciplines (Passow, 1982), and exploring epistemological issues (Hayes-Jacobs & Borland, 1986).

Advanced understanding is also attained through examining curricular topics in more breadth and/or with greater depth (National Association for Gifted Children [NAGC], 1994; Purcell, Burns, Tomlinson, Imbeau, & Martin, 2002; Shore et al., 1991; Tomlinson, 2005; United States Department of Education [U.S. DOE], 1993; VanTassel-Baska, 2005; Ward, 1980). Breadth may refer to exposing students to wide variety within or across a content area (Renzulli & Reis, 1997) or, more simply, to extending the core curriculum (Kaplan, 1979). Kaplan (1979, 1994) defines depth as ways of intensifying curriculum—some of which might include using the language of the discipline and examining details, trends, patterns, unanswered questions, rules, ethics, big ideas, and relationships to time. Exploring content in depth also might involve students pursuing an area of special interest at a high level (VanTassel-Baska, 1989), studying important issues and problems related to a topic (VanTassel-Baska, 2005), or spending more time on learning a topic (Kaplan, 1974).

Complexity is another way of modifying the curriculum to advance understanding (NAGC, 1994; Passow, 1982; Purcell et al., 2002; Tomlinson, 2005; Ward, 1980). Content is more complex when it is more challenging and intricately detailed; integrates knowledge and concepts from various disciplines; requires higher level thinking processes; and incorporates different perspectives, theories, principles, and concepts associated with what professionals in the discipline know and do (Kaplan, 1974; Maker & Nielson, 1996; Rogers, 2002). Processes and products are more complex when they involve more steps or require more advanced resources, tasks, issues, problems, skills, or goals (Tomlinson, 1997). For example, students might work with multiple abstractions; merge what they are learning with previous learning or tackle problems that require more originality or elegance in their solutions (Tomlinson, 1999).

Principle 3: High-Quality Curriculum for Gifted Learners Asks Students to Use Processes and Materials That Approximate Those of an Expert, Disciplinarian, or Practicing Professional

Educators with an interest in gifted learners reason that students with advanced capacities may be more ready than their peers at an earlier age to work like experts in a discipline. This includes approximating authentic processes and accessing sophisticated materials.

Processes both general and specific to the various disciplines should be employed in curriculum for gifted students (e.g., Renzulli et al., 2000; Tomlinson et al., 2002). General methods are those that emphasize discovery and equip students to follow research or inquirybased procedures, such as assessing the credibility of a resource, following through on an investigation, and learning how to learn other necessary skills on-demand (Maker & Nielson, 1996; Passow, 1982; Renzulli & Reis, 1997; VanTassel-Baska & Little, 2003). Each discipline has its own ways of conducting research and solving prob lems as well. The specific ways that practicing professionals work and act are a defensible, desirable aspect of curriculum for gifted learners (Renzulli et al., 1997; Tomlinson et al., 2002; VanTassel-Baska & Little, 2003).

Working like an expert also involves thinking like one. Integrating higher level processing skills in the curriculum—those an expert is likely to use—is therefore crucial. These might include processes for thinking critically, analytically, and creatively; making decisions; asking questions; generating new ideas; defending ideas;

reconciling opposing viewpoints; reconceptualizing and transferring knowledge; and solving problems (Kaplan, 1974; Maker & Nielson, 1996; Passow, 1982; Purcell et al., 2002; Renzulli & Reis, 1997; Rogers, 2002; Tomlinson et al., 2002; VanTassel-Baska, 1998). Curriculum for gifted learners also approximates expertise by developing metacognitive abilities and self-understanding (Kaplan, 1974, 1979; Passow, 1982; Tomlinson, Kaplan, & Hedrick, 2005; VanTassel-Baska, 2005). All thinking processes must be rooted in content and be a means to an end, rather than taught in isolation (Shore et al., 1991).

The materials that gifted students should use are often described by experts as advanced. These might include resources that are specialized, more varied, more abstract, and require higher level reading or processing skills; that treat knowledge as tentative; and that illustrate interdisciplinary connections through concepts (Kaplan, 1974; Passow, 1982; Tomlinson, 1997; VanTassel-Baska, 2005; VanTassel- Baska & Little, 2003). In any case, students will likely need guidance or instruction in how to use these resources (Renzulli & Reis, 1997).

Principle 4: High-Quality Curriculum for Gifted Learners Emphasizes Problems, Products, and Performances That Are True-to-Life, and Outcomes That Are Transformational

In the real world, people pursue the problems most important and interesting to them. These problems are not always well-defined or structured, but they are significant in some way to individuals, communities, societies, or fields of study. They call for specific and broadbased knowledge, understanding, skills, and processes. At the same time, no formula exists for discovering their solutions. Personal traits and dispositions may be just as important to finding these answers as formal training. Those with expertise in curriculum for gifted learners advocate making learning experiences more aligned with this kind of problem finding and resolution.

Renzulli (1982) represented gifted education's rationale for integrating problem solving into curriculum for highly able learners:

If mankind's creative producers and solvers of real problems are constantly held up before us as idealized prototypes of the "gifted person," then it seems nothing short of common sense to use their modus operandi to construct a model for educating our most promising young people. (p. 148)

A defining characteristic of these kinds of problems is authenticity— they mirror problems or are problems in the real world with either no existing solution or a solution that is unknown to the student, are directed toward change or the production of new knowledge, and have a personal frame of reference for the student (Maker & Nielson, 1996; Purcell et al., 2002; Renzulli, 1982; Renzulli & Reis, 1997; Rogers, 2002; Tomlinson, 2005; VanTassel-Baska & Little, 2003).

This type of problem solving also involves the development of authentic products directed at real audiences. The products emulate those developed by practicing professionals in a field or at least have a discipline-based foundation (Purcell et al., 2002; Renzulli & Reis, 1997; Shore et al., 1991; VanTassel-Baska, 1989). They are evaluated by qualified persons, such as expert judges or audiences who stand to benefit from the results, according to advanced criteria or goodnessof- fit for a certain need (Maker & Nielson, 1996; Renzulli, 1982; Rogers, 2002; Tomlinson, 2005; Ward, 1980).

In problem solving, product development, and performance, gifted curriculum experts promote students working toward outcomes that are transformational (Purcell et al., 2002; Rogers, 2002; Tomlinson, 2005). More specifically, students take the knowledge they have learned and view it from another perspective through reinterpretation or extension (Maker & Nielson, 1996), form new generalizations and ideas (Kaplan, 1974, 1979), and develop skills into creative forms for real audiences (Passow, 1982; Renzulli & Reis, 1997).

Principle 5: High-Quality Curriculum for Gifted Learners Is Flexible Enough to Accommodate Self-Directed Learning Fueled by Student Interests, Adjustments for Pacing, and Variety

Curriculum experts in gifted education have been strong advocates of individualizing learning experiences for highly able students, due in part to the perceived inadequacy of the general education curriculum to meet these learners' academic needs (e.g., Passow, 1955; VanTassel-Baska, 1995; Ward, 1980). Under the assumptions that (a) the regular curriculum is inappropriate, and (b) gifted students' time would be better spent pursuing what they want to learn, several program models include flexible components that allow students to set the course for their own learning (e.g., Betts, 1985; Feldhusen & Kolloff, 1979; Renzulli, 1977).

Beyond specific models, experts view flexibility in curriculum for gifted learners in several ways. First, it involves learners making choices about the direction and goals of their learning (Purcell et al., 2002; Shore et al., 1991; VanTassel-Baska & Little, 2003). Therefore, tasks should be open ended, with no one right answer (Kaplan, 1979; Maker & Nielson, 1996; Tomlinson, 2005; VanTassel-Baska, 2005). In these endeavors, students should be encouraged to investigate areas of interest more in depth (Kaplan, 1979; Landrum & Shaklee, 2000; Maker & Nielson, 1996; Purcell et al., 2002; U.S. DOE, 1993; VanTassel-Baska, 1989) as well as develop skills that support selfdirectedness, such as organization, time management, self-assessment, using resources, and decision making (Kaplan, 1979; Passow, 1982; Renzulli & Reis, 1997; Tomlinson, 2005).

Second, flexibility in curriculum for gifted learners requires adjustments for pacing (Maker & Nielson, 1996; NAGC, 1994; Purcell et al., 2002; Tomlinson, 2005; U.S. DOE, 1993; VanTassel- Baska & Little, 2003; Ward, 1980). This may mean increasing the pace of learning by moving students more rapidly through basic skills (VanTassel-Baska, 1989) or an entire course of study (Shore et al., 1991). Pacing also might be decreased to account for gaps in students' knowledge, skills, or understanding; to accommodate indepth study; or to make sure a student can apply what he or she has learned (Tomlinson, 2005).

A third, more generic attribute of flexibility in curriculum is variety. This might include variety in instructional approaches and materials, content and form, learning activities, skills, or learning opportunities (Maker, 1986; NAGC, 1994; Landrum & Shaklee, 2000; Purcell et al., 2002; U.S. DOE, 1993).

Overlap and Distinction Between Quality Curriculum Endorsed by General Education and by Gifted Education

The curriculum promoted by general education curriculum experts for all learners and the curriculum promoted by experts in gifted education curriculum for highly able learners have more in common than they do at odds. There are no attributes of curriculum emphasized by either field that are in direct conflict with one another. Broadly, both agree that high-quality curriculum is authentic, outcome driven, flexible for individual differences, and challenging. Distinctions are primarily differences in rationales and emphases. In general education, curriculum experts and professional organizations tend to base their recommendations on research; whereas, gifted education grounds its curricular guidance on presumed characteristics and needs of gifted learners as a whole. Some differences lie in

how the attribute is framed or to what degree it is stressed. A discussion of the four major categories of overlap and the distinctions between general education and gifted education viewpoints follows.

High-Quality Curriculum Is Authentic

Experts in general education and gifted education agree that curriculum must be authentic: true to the disciplines; guided by the way experts work and think; focused on real problems, processes, and products; personally relevant; and integrated. With different populations in mind—general education emphasizing a broader spectrum of learners than does gifted education—the rationales underlying these characteristics distinguish perspectives in the two fields.

For general education, a strong discipline base provides curricular integrity, facilitates learning, brings meaning to content, and prepares students for how they will work and live in the real world. Curriculum leaders in gifted education stress that curricula for highly able learners have a discipline foundation so that students are better equipped to make interdisciplinary connections and creative-productive contributions. In the same way, gifted education reasons that curriculum should prepare students to work and think like experts because preparation for life as a contributor to a discipline or field is a major purpose of gifted education; whereas, general education promotes expertise as a major purpose of education for all students.

Authenticity in product development, problems, and processes is central to quality curriculum for general education and gifted education. For the former, it increases the student's engagement and sense of curricular purpose. Experts in gifted education suggest that authentic products, processes, and problems are especially motivating for highly able learners. Similarly, general education's promotion of real-world problem solving is founded in making curriculum relevant for students and as one way among many to gauge how well students understand given concepts. For curriculum experts in gifted education, problem solving is a primary means of assessing and engaging students and is integral to training gifted students for their futures as problem solvers.

Integration as a means of making curriculum more authentic is also common among curriculum voices in each field. Gifted education views integration primarily as a way to differentiate curriculum for highly able learners, while general education considers integration primarily a way to help all students understand and apply interdisciplinary connections.

High-Quality Curriculum Is Driven by Meaningful Outcomes

Both general and gifted education curriculum experts endorse meaningful outcomes for curriculum. They agree that acquiring deep or advanced understanding is one such goal. Interestingly, general education highlights the development of expertise as a learning outcome more prominently and emphatically than do many of their counterparts in gifted education. General education curriculum leaders views expertise as developmental and progressive, occurring over the course of a student's K–12 education. Gifted education views expertise as talent development: Because gifted learners are presumed to be more ready for expert-like endeavors than their peers, any further concentration on or development of their abilities should be attained through learning advanced, discipline-based conceptual content and developing products or new insights.

One final distinction regarding outcomes is that among general education voices, outcomes are predetermined by the teacher, curriculum writer, school, district, or state. Gifted education supports more open-ended outcomes, those that might vary depending on how curriculum is adjusted for students' interests, capacities, or choices.

High-Quality Curriculum Is Flexible to Account for Student Differences

Curriculum leaders in gifted education would not disagree with general education's premise that a primary reason curriculum should be flexible is that students differ from one another in a variety of ways and, in order to reach certain learning outcomes, will require curricular adjustments based on their individual traits. Predictably, gifted education curriculum quality indicators are concerned with curriculum being flexible enough to accommodate differences specific to gifted students. These accommodations might include chances to make choices about learning, exercise independence, progress through curriculum at a faster or slower rate, and access curriculum that is qualitatively distinguished from the general education curriculum.

To uncover student differences, general education strongly supports using preassessment. Gifted education curriculum experts favor preassessment as well, but primarily as a way of documenting what the teacher should already suspect based on general characteristics of gifted learners: They already know the regular curriculum content, are able to move through it more quickly, or require other provisions for curriculum differentiation.

High-Quality Curriculum Is Challenging

Although experts and organizations in both fields believe challenge is a vital attribute of high-quality curriculum, gifted education is more explicit than is general education about what forms challenge might take. As a whole, their recommendations mirror their indi cators of high-quality curriculum. So, for gifted education experts, challenge comes through conceptual teaching, a discipline-based focus, approximating experts, abstraction, depth, breadth, complexity, integration, choice, varied pacing, interest-based learning, solving real problems, and product development. General education recommendations for providing challenge are more vague: holding high expectations for all students, supporting students' weaknesses, and fortifying students' strengths. Enrichment, depth, and increased pacing are also mentioned.

An additional theme in describing challenge in curriculum for both groups of curriculum experts is developmental appropriateness. Here, perspectives conflict somewhat. Voices in general education curriculum have begun to assert that curriculum should be more challenging than it is in many schools because, developmentally, children are more capable than current school curriculum, curricular materials, and teachers suppose. In gifted education curriculum literature, too much attention to developmental appropriateness in curriculum—especially with regard to age or grade level—is considered a potential hindrance to providing appropriate challenge, unless educators account for developmental variety in any population of students.

The Potential of Three Gifted Education Curriculum Models to Contribute Quality Curriculum for General Education and to Address the Needs of Highly Able Learners

Three curriculum models authored by gifted education curriculum experts offer promise for designing curriculum that conforms to general education and gifted education indicators of quality. Although the term curriculum model is sometimes used in gifted education to include programming and service-delivery models or administrative arrangements, in this paper it refers to models for designing academic content, process, and products for highly able learners that represent the "core" of what students learn and the material for which they are held academically accountable. The three models discussed in this paper—the Integrated Curriculum Model, the Multiple Menu Model, and the Parallel Curriculum Model—conform to this definition. The following sections summarize the models, examine evidence of their effectiveness, and discuss how the models might contribute to general education curriculum design and address the needs of highly able learners.

Integrated Curriculum Model

Summary. The Integrated Curriculum Model (ICM; VanTassel- Baska, 1986, 1994; VanTassel-Baska & Little, 2003) is rooted in several curricular approaches recommended in gifted education literature (i.e., Benbow & Stanley, 1983; Maker, 1982; Ward, 1980) and on several characteristics of gifted learners, namely, precocity, intensity, and complexity. To attend to these needs, the model employs three interrelated dimensions: an advanced content dimension, a processproduct dimension, and a concepts/issues/ themes dimension.

The model's process-product dimension encourages in-depth, independent learning by incorporating higher order thinking and processing. The curricular framework addresses this component through Paul's (1992) elements of reasoning as well as a research model for helping students produce original oral and written work (Boyce, 1997). Science units incorporate this dimension through the scientific research process and student-designed experiments.

The concept/issue/theme dimension centers students' learning experiences on major issues, themes, and ideas with theoretical and real-world inter- and intradisciplinary applications. Language arts and select social studies units revolve around the concept of change. Additional social studies units are organized by themes related to either cause and effect or systems. Science units are centered on systems also. The science curriculum includes a problem-based learning approach that examines how science systems relate to real-world systems in social, political, and economic realms.

Other features of the model's curricular framework that pervade the units are provisions for accelerated/compressed content, opportunities for students to develop advanced products, extensions based on student capacity and interest, and training in metacognitive skills (VanTassel-Baska & Little, 2003).

Evidence of Effectiveness. The ICM is the most researched of any model for designing differentiated curriculum for gifted learners. The Center for Gifted Education at The College of William and Mary has developed more than 25 units based on the model across language arts, science, social studies, and math, as well as 18 novel study guides for advanced readers, a reading comprehension enhancement program, and other curriculum support materials.

Six studies comprise the ICM research base (Feng, VanTassel- Baska, Quek, Bai, & O'Neill, 2005; VanTassel-Baska, Avery, Little, & Hughes, 2000; VanTassel-Baska, Bass, Ries, Poland, & Avery, 1998; VanTassel-Baska, Johnson, Hughes, & Boyce, 1996; VanTassel-Baska & Stambaugh, 2006; VanTassel-Baska, Zuo, Avery, & Little, 2002). Collectively, these studies assess the impact of the curriculum units designed with the model on students' growth in specific process skills as well as how effective various stakeholder groups perceived the units were.

Impact on student growth. Studies on select William and Mary language arts and science units have employed pre- and posttest quasiexperimental design to measure student gains in literary analysis, literary interpretation, persuasive writing, and scientific research skills. The first of these studies (VanTassel-Baska et al., 1996) examined the influence of a language arts unit implemented over the course of one year in seven experimental classes of 100 identified gifted students in grades 4–6 and three control classes of 54 students in grades 4–6. The treatment group improved significantly in all three assessment dimensions of literary analysis, persuasive writing, and grammar, with the highest effect sizes in literary analysis and grammar. The comparison group did not show significant growth in any of the three areas; however, it is worth noting that the comparison unit was literature based and emphasized creative writing.

In a longitudinal study of the effect of ICM-based units on students who had been exposed to the language arts and science curriculum over time, Feng et al. (2005) found statistically and practically significant gains from pre- to posttests on literary analysis, persuasive writing, and scientific research at grades 3, 4, and 5. Additionally, repeated exposure data for grade 5 students evidenced significant pre- and posttest gains on literary analysis, persuasive writing, grammar, and scientific research skills, regardless of whether they had been exposed to the units one, two, or three times. Data also suggested that the experimental group means increased with exposure.

VanTassel-Baska et al. (2002) used a database of performancebased assessment results accumulated over a 5-year period from 46 schools in 10 states to determine the effect of four ICM-based language arts units on 2,189 preidentified gifted students. The treatment groups showed increased gains in literary interpretation and analysis skills and persuasive writing. The treatment was effective regardless of gender, grouping arrangement, or socioeconomic status.

A science unit entitled "Acid, Acid Everywhere" was the focus of a study that examined the ICM's efficacy on gifted students' scientific reasoning (VanTassel-Baska et al., 1998). Alternate forms of the Diet Cola Test (Fowler, 1990) were administered prior to and following unit implementation in 45 experimental classrooms and 17 comparison classrooms. ANCOVA results showed significant differences between the groups.

VanTassel-Baska and Stambaugh (2006) studied the impact of a reading comprehension program derived from ICM on groups of students from seven high-poverty school districts in grades 3–5 who had not been identified as gifted. The program focused on moving students toward higher order thinking skills in language arts. Preliminary findings showed that the experimental group scored significantly better than the control group on measures of critical thinking and reading comprehension, and all ability groups and ethnic groups demonstrated significant critical thinking and reading comprehension, and all ability groups and ethnic groups demonstrated significant growth gains. This study also examined how the program affected teacher instruction. Experimental teachers scored significantly higher on both the frequency of use of differentiated strategies and effective use differentiated strategies dimensions on a classroom observation scale.

Perceptual data. Research on selected ICM units also has sought to gauge administrator, parent, teacher, and/or student perceptions of the curriculum. Qualitative data from modified case studies of two schools that used several science and language arts units for 3 years revealed that teachers, students, parents, and administrators held positive perceptions of the units (VanTassel-Baska et al., 2000). Teachers noted the units' influence on their teaching competency as well as on student engagement, reasoning skills, and habits of mind. Teachers also reported high student motivation and engagement in other ICM studies (VanTassel-Baska et al., 1998; VanTassel-Baska et al., 2002).

Feng et al. (2005) found that the majority of teachers and parents perceived selected language arts and science units as challenging, while a slight majority of students perceived the units as sometimes challenging, but not always. Almost all parents surveyed (92%) were satisfied with overall program curriculum, as were a majority (66%) of teachers. Additional advantages of the science curriculum teachers cited in other research included the student-centered aspect of the units, connections to the real world, and extended benefits to all learners, including those identified as gifted (VanTassel-Baska et al., 1998).

Teachers, students, and parents reported several disadvantages of the curriculum as well. Both teachers and students noted a lack of variety in reading materials, and teachers noted a lack of flexibility in selecting unit materials (Feng et al., 2005). Teachers also felt they needed more content-knowledge background to implement the units (Feng et al., 2005) and that the unit implementation required too much paperwork (VanTassel-Baska et al., 1998). In one study, parents and teachers cited inconsistency in unit delivery and instructional quality (Feng et al.).

Potential for Simultaneously Contributing to General Education Curriculum Design and Addressing the Needs of

Highly Able Learners. Although it is designed specifically for gifted-learner characteristics of precocity, intensity, and complexity (VanTassel-Baska, 1995), the ICM emphasizes several components that general education also emphasizes in its indicators of high-quality curriculum. First, the ICM employs a concept-based approach. These concepts are consistent among, and in some cases across, units in various disciplines. Abstractions like systems, change, and cause and effect make complex ideas and content more accessible to students while pushing their thinking to integrated forms.

In the development of expertise, ICM equips students with discipline- relevant knowledge and skills, uses methods and materials authentic to the discipline, and incorporates instruction in metacognition. ICM units within and across grade levels evidence consistency by emphasizing similar processes, themes, and applications. Students revisit and use models of thinking- and research-process methods from unit to unit.

Learning outcomes for ICM-based units are clearly delineated. Most activities and lessons are designed toward solving a real-world problem or creating a product. Pre- and postassessments measure student growth relative to the unit goals. The problem-based learning approach of the science curriculum gives students chances to apply what they have learned to a situation that approximates realworld challenges related to the unit's science concepts. For example, "Electricity City" (Center for Gifted Education, 1997) poses the problem of designing electrical plans for a new recreational center.

The advanced content dimension of ICM is the aspect most exclusive to highly able learners. This is mostly delivered by introducing content, materials (e.g., reading selections, vocabulary), ideas, and processes earlier than they would be in a typical grade-level sequence. A language arts unit on persuasion designed for use with high-ability students in grades 5–7, for instance, asks students to read the Declaration of Independence and The Valiant as vehicles for exploring analytical reasoning processes (Center for Gifted Education, 1998).

Multiple Menu Model

Summary. The Multiple Menu Model (MMM; Renzulli, 1988; Renzulli et al., 2000) is an approach to designing differentiated curriculum that is based on the work of curriculum and instruction theorists in general education (Ausubel, 1968; Bandura, 1977; Bloom, 1954; Bruner, 1960, 1966; Gagné & Briggs, 1979; Phenix, 1964) and gifted education (Kaplan, 1986; Passow, 1982; Ward, 1961). Using six practical planning guides, the model stresses balance between authentic content and process, epistemological relationships and structures, and experiential inquiry. Taken together, the menus synthesize students' specific capacities, interests, and learning preferences; teachers' discipline knowledge, pedagogical proficiency, and passions for the material; and the structure, content, and methodology of the discipline (Renzulli, 1997).

The cornerstone of the MMM is the Knowledge Menu--a rigorous examination of how a discipline is organized and structured; where it is located in the larger body of knowledge; what its fundamental concepts, principles, and methods are; and which topics best represent its nature and its contributions to universal wisdom. Practically speaking, the Knowledge Menu is a vehicle for teachers and students to explore meaning and authenticity in curriculum. Students explore the big ideas and essential understandings of a discipline, engage in activities that mimic what practicing professionals do, and make meaning from important concepts and principles through application.

Four menus comprise the Instructional Techniques section of the MMM. The Instructional Activities and Student Activities Menu helps teachers plan how students will learn, retain, analyze, synthesize, and apply information, as well as how students will be evaluated. Using the Instructional Strategies Menu, teachers decide what techniques are most appropriate for engaging students with the content. The Instructional Sequences Menu provides guidance for organizing and sequencing learning activities or lessons to make sure students reach the outcome. Accordingly, this menu lists strategies for piquing student interest in a topic, communicating lesson objectives to students, determining students' prior knowledge relative to the objectives, presenting the material, providing extensions or follow-up opportunities, assessing student performance, and helping students transfer knowledge to new situations. The Artistic Modification Menu is a way for teachers to paint themselves into the curriculum picture by incorporating their own experiences, values, and knowledge into previously developed materials.

The sixth menu, the Instructional Products Menu, focuses on what concrete and abstract products will indicate student mastery of the learning outcomes. Concrete products might be performance based, leadership driven, artistic, visual, written, or oral. Examples of abstract products are cognitive or affective skills and attitudes, such as problem-solving skills or improved self-efficacy. In all cases, products are authentic to the discipline.

Evidence of Effectiveness. The recent and anticipated publication of units based on the MMM (e.g., Murdock, 2006) offers potential for examining its effectiveness, but no research has been conducted on the model to date.

Potential for Simultaneously Contributing to General Education Curriculum Design and Addressing the Needs of Highly Able Learners. The MMM's potential contribution to general education curriculum design is most evident in the Knowledge Menu. As a tool for interrogating the discipline for its essential concepts, principles, processes, and structure, the Knowledge Menu is constructive. It requires teachers to have a deep understanding of the discipline and is useful for guiding students' thinking toward placing the discipline in a larger context. Students understand why the discipline "matters" and make interdisciplinary connections. The Knowledge Menu is also the basis for authentic instructional activities and products that approximate what real professionals in the discipline or field do and produce.

The MMM stresses applying research process skills and methodologies through the study of topics that best represent the essence of the discipline. This fuels first-hand, in-depth investigative learning. Ideally, the problems are as true-to-life and relevant to student experience as possible. The selection of basic principles, functional concepts, and representative topics exemplify a conceptual approach to the discipline through which students are able to distill a wider body of knowledge, skills, and understanding that they can eventually transfer to other disciplines and situations.

The impetus for differentiated curriculum for gifted learners in the MMM is the assumption that they are the future's creative producers— inventors, leaders, artists, and so on. Toward this end, MMM seeks to address the needs of highly able learners by creating conditions in which students can produce "new" knowledge via authentic forms. Options within the instructional strategies menu stress higher level cognitive processes, less structured teaching methods, and attention to controversial issues, values, and beliefs (Renzulli, 1988). Similar to the conclusion in How People Learn (NRC, 1998) that expertise is more a matter of having the conceptual tools for finding and organizing information than it is memorizing all potentially relevant facts, MMM gives highly able learners access to these and other intellectual processes that experts use to think and work.

Parallel Curriculum Model

Summary. The Parallel Curriculum Model (PCM; Tomlinson et al., 2002) endeavors to design high-quality curriculum that will be appropriately challenging for all learners, including the gifted. One of its key premises is that good curriculum for the gifted must start with good curriculum for learners of all ability levels. The PCM authors acknowledge, "The boundaries between high-quality curriculum for all learners and high-quality curriculum for gifted learners are blurred because of developmental and experiential variance among learners" (Tomlinson et al., 2002, p. 4). There is no single kind of gifted learner, according to the PCM, and any teacher who is effective in developing high-potential learners is well-versed in what exemplary curriculum is in general.

Four parallels comprise PCM: (a) the Core Curriculum, which, in addition to being the basis for the three other parallels, is based on the discipline's knowledge and includes standards, principles, concepts, and key facts and skills; (b) the Curriculum of Connections, a kind of interdisciplinary study taken one step further so that students find inter- and intrarelationships between concepts and principles in various fields of study, instances, and contexts; (c) the Curriculum of Practice, the goal of which is to help students function as practicing professionals in the field; and (d) the Curriculum of Identity, a way for students to examine themselves through the lens of a particular discipline.

The model identifies 10 curriculum components that are key to planning any effective curriculum, including one designed with the PCM: content (standards), assessments, introductory activities, teaching strategies, learning activities, grouping strategies, products, resources, extension activities, and modifications for learner need. Although not all of these elements may prove necessary for every lesson, together they form a cogent, defensible plan for teaching students well.

A distinguishing feature of PCM is its concept of ascending intellectual demand (AID)—in essence, a way of defining the nature of challenge in curriculum (Tomlinson, 2005; Tomlinson et al., 2002; Tomlinson et al., 2005). AID acknowledges that all students need to progress toward expertise as they are ready. As learners attain more advanced levels of knowledge, understanding, and skill in a domain, they must be challenged just above what they are able to do without support—if they are to continue to make meaningful progress. This is achieved by continuously approximating the behaviors and processes that characterize the work of experts in general, or the work of an expert in a particular field, at escalating stages—novice, apprentice, practitioner, and expert. Examples of increasing challenge for learners who are ready for a more advanced stage include working with more advanced or authentic materials, connecting seemingly contradictory ideas, working with unstructured problems, and reflecting on the truths and beliefs that pervade a discipline (Tomlinson et al., 2005).

Evidence of Effectiveness. Research on the PCM has yet to be conducted. However, results from an evaluation report on a Javits grantsponsored project that supported teachers in designing science and social studies PCM units are available (Callahan, 2005). One facet of the project involved field-testing four units in heterogeneous classrooms in several states. Pre- and postassessment results for one of the four units (an astronomy unit) indicated that the experimental group showed larger gains on the posttest measure than did the control group ($F = 21.044$, $p < .000$). Although the experimental groups evidenced considerable growth with the other units, the posttest scores did not differ significantly from those of the control groups. Notably, the four units used in this evaluation were developed by classroom teachers who received training in the PCM, not by professional, university, or district-level curriculum writers, or by the creators of the model itself. Two PCM authors oversaw the training and unit design.

A book of ready-to-use PCM units representing various subject areas and grade levels is available (Tomlinson, Kaplan, Purcell, et al., 2005), and publication of additional units is in development (C. A. Tomlinson, personal communication, November 24, 2006).

Potential for Simultaneously Contributing to General Education Curriculum Design and Addressing the Needs of

Highly Able Learners. Perhaps because it is founded on the idea that high-quality curriculum for gifted learners starts with high-quality curriculum for all learners, the PCM is replete with connections to general education's curriculum principles. Because flexibility is a hallmark of the PCM, it views neither curriculum for learners as a whole, nor curriculum for the subpopulation of highly able learners, as uniform. Assessment drives modification for learner need, including adjustments for AID.

The Core Curriculum explores the essential nature of the discipline by focusing on its concepts, principles, and processes. All students learn content that is important and enduring, contributes to deep understanding, and equips them to work like professionals in a field.

The PCM provides a practical way of planning for the development of expertise—a primary purpose of curriculum articulated by general education curriculum experts—through AID. Students are expected to become more independent, reflect on their learning and thinking, master discipline-relevant knowledge, and use authentic methods and materials. Tools like general and discipline-specific "novice to expert" continua and lists of prompts leading to AID for each parallel help teachers and curriculum writers transition from conceptualizing AID to planning for it (see Tomlinson et al., 2005).

The PCM also represents integrated curriculum in several ways. In the Curriculum of Connections, students relate core concepts, principles, knowledge, and skills within and across disciplines, real-world contexts, and various time periods and cultures. The Curriculum of Practice requires students to apply their knowledge to discipline-specific skills and processes. The Curriculum of Identity prompts students to find themselves in the discipline, reconciling it with their personal identities and experiences. When the parallels are used in combination with another, or in full concert, the result is a relevant, complex, multidimensional study that balance breadth with depth.

Specific to the needs of highly able learners, the PCM might be viewed as vehicle for identifying and developing talent. AID provides specific ways to challenge learners at various levels and for particular strengths. Because expert-like performance, behaviors, and products are the benchmark rather than a higher grade-level's curriculum, students have more flexibility to develop areas of strength and weakness simultaneously and without the assumption that because they are highly able, they should be able to do x, y, and z.

Areas for Growth in General Education and Gifted Education in Addressing the Needs of Highly Able Learners

Neither general education nor gifted education has "arrived" at the destination of sufficiently addressing the needs of the many types of highly able learners though curriculum. Prospects for growth en route are favorable, given the degree of alignment between what both fields believe exemplary curriculum is. This section identifies and describes specific ways that general education and gifted education, respectively, can improve the curricular climate for gifted learners.

Areas for Growth in General Education

1. Be explicit about what challenge is and what it looks like in curriculum. Research indicates that classroom teachers have difficulty with and often lack training in how to consistently provide appropriately challenging curriculum alternatives for advanced learners (Archambault et al., 1993; Brighton, Hertberg, Moon, Tomlinson, & Callahan, 2005; Moon, Callahan, Tomlinson, & Miller, 2002; Moon, Tomlinson, & Callahan, 1995; Reis & Purcell, 1993). Although general education experts and organizations call for challenge, they often are not explicit about what forms challenge should or might take for the full range of learners, including those who demonstrate exceptional competency or interest. Terms like enrichment and in depth present ambiguity for the practitioner unless accompanied by sound rationale and defensible examples. Textbooks or other resources may label activities, homework, or lessons as challenge, but such labels do little to help teachers develop meaningful conceptions of challenge, or to support the truth that challenge comes in different forms for different students, even among students who are highly able.
2. Emphasize teacher content knowledge/training in the discipline as requisite to teaching all students well. National science and math standards publications illustrate that guidance and criteria for designing meaningful, rigorous curriculum are readily available (NCTM, 2000, 2006; NRC, 1996). These and similar documents exhort that teachers are well-versed in disciplines they teach. Poor or limited mastery of one's subject area is a potential barrier to recognizing when students are more advanced in their understanding of curriculum concepts as well as to identifying student weaknesses. In addition, it is unlikely that teachers will be able to render standards into curriculum and instruction unless they are proficient in the discipline. Strong content knowledge often is cited as an important prerequisite for teaching gifted learners (Borland, 1989; Gallagher, 2000; Landrum, Callahan, & Shaklee, 2001; Mills, 2003; VanTassel-Baska & Stambaugh, 2005). However, there is no research to suggest that content knowledge is more essential to teaching gifted learners well than to teaching other learners well. At the very least, strong content knowledge is as important for meeting the needs of highly able learners as it is for meeting the needs of all learners.
3. Distinguish standards from curriculum. With the prospect of yearly accountability testing, many classroom teachers may be hard-pressed not to equate standards with curriculum, and vice versa. Some state and professional organization standards documents include corresponding performance descriptors, classroom assessments, and sample lessons (e.g., Illinois State Board of Education, 2001; NRC, 1996). Although these may help teachers envision practical ways to translate the standards for instruction, they also may result in activity-driven curriculum with few opportunities for students to apply content in meaningful ways or understand what a discipline is really about. In short, standards supplemented by activities do not comprise curriculum either by general education or gifted education barometers. Helping teachers understand what curriculum is and providing training on tools for designing outcome-based curriculum might clarify how standards are related to (yet not sufficient for) curriculum.

Areas for Growth in Gifted Education

1. Provide clarity about which attributes of high-quality curriculum are specific only to highly able learners. In discussions about curriculum for highly able learners, it often is not clear which aspects of high-quality curriculum gifted education experts and organizations promote as being more appropriate to or exclusively for the many kinds of gifted students. Consider gifted education's long-time, well-founded promotion of integrating concepts into curriculum. General education now also promotes a concept-based approach. The charge for curriculum experts in gifted education then becomes distinguishing how conceptually based

charge for curriculum experts in gifted education then becomes distinguishing how conceptually based curriculum for highly able learners is related to and differs from conceptually based curriculum for all learners. Not surprisingly, U.S. math teachers reflect a dominant international pattern of using conceptual teaching approaches more with high-performing students than with low-performing students. And, in contrast with other nations, U.S. math teachers use more computational approaches with low-achieving students than with high-achieving students (Desimone, Smith, Baker, & Ueno, 2005). Curriculum leaders and organizations across gifted and general education should work to distinguish for teachers the difference between conceptual approaches that are appropriate for all learners, and which, if any, are more appropriate to gifted learners. Similar guidance for other curriculum components advocated by both fields (e.g., problem solving) also would enhance curricular quality for all students and ensure highly able learners are working at levels commensurate with their abilities.

2. Promote research-based approaches to curriculum over approaches based on generic group characteristics. Some justifications for and explanations of curriculum differentiation for gifted learners have relied on generalizations and attributes rooted in the beliefs that these students are a homogeneous group. For example, asserting that gifted learners need curriculum that covers topics in depth because gifted learners in general long for in-depth learning not only encour ages a single-minded perspective on curriculum for them but also overlooks students who may be highly able yet are unmotivated by the prospect of prolonged study on a particular topic, even one of personal interest. Moreover, given the appropriate opportunities or stimuli, many students, gifted or not, would likely relish (and should experience) in-depth learning in some form. Moving away from basing curriculum recommendations and models on presumed characteristics of gifted learners and toward recommendations based on research will ensure a more defensible (and sympathetic) rationale for those curricular adjustments that are more appropriate for highperforming and high-potential students. In addition, it may be influential in moving toward conceptions of giftedness that are focused on the kind of variance inevitable in any population, thereby encouraging greater attention to high-potential learners from low socioeconomic backgrounds, cultural and racial minority groups, and twice-exceptional populations.

3. Demonstrate the effectiveness of curricular units that are designed with highly able students in mind for use with a variety of gifted learners and with all learners. Gifted learners are a heterogeneous group. Units, lessons, or activities created with their general characteristics in mind may or may not be more challenging than those not so designed, depending on the philosophy and expertise of the author(s). That challenge or curriculum appropriate for the range of advanced students, or for any group of students or individual student, regardless of ability, is intrinsic to certain units contradicts our sensibilities. No set of curricular materials, regardless of their intended recipients, is appropriate "as is" for a group of students. Even the highest quality curriculum needs to be tailored for specific learner needs.
It has been suggested that curriculum for all students could be improved by improving it for gifted learners (VanTassel-Baska, 1994), and that gifted education can (and has) contributed important insights and research on curriculum differentiation to general education practice (Tomlinson & Callahan, 1992). But, unless gifted education is willing to illustrate how exemplary curriculum for gifted learners can be translated to the regular classroom setting, the potential for enhancing general education curriculum quality is limited. The three curriculum models reviewed in this paper are capable of bold and legitimate responses to general education appeals for exemplary curriculum. There is little reason they should be reserved only for designing gifted program curricula, nor do they claim to be appropriate only for a gifted population. Curriculum writers and the district- or state-level agencies that employ them might consider designing curriculum with highly able learners in mind, incorporating one or more of these models, and then demonstrating how those units can be used with all learners. Published units designed according to the PCM have sought to do this by including and clearly delineating specific modifications for learner need and adjustments for AID (Tomlinson, Kaplan, Purcell, et al., 2005). This and similar approaches to unit design bode well for extending what gifted education has learned about high-quality curriculum to general education curriculum design.

4. Strengthen and extend research on curriculum models appropriate for highly able learners. Continued research on what curriculum models are most effective with the many types of gifted learners is needed. It may be remiss to assume that because an instructional unit results in higher achievement gains for gifted learners than for other learners— or because it results in gains for gifted learners at all—it is exemplary curriculum for gifted learners, or, by exclusion, it is better or more appropriate for gifted students than for students not so identified.
Studies demonstrating that curriculum units designed according to a particular model result in positive achievement gains for traditionally identified gifted learners (e.g., Callahan, 2005; VanTassel- Baska et al., 2002) warrant additional lines of inquiry. For example, to what extent do these units have the potential to also increase achievement for all kinds of learners, including those who have not been formally identified as gifted? Researchers have begun to investigate the potential of the ICM in this regard (VanTassel-Baska & Stambaugh, 2005). Future research on the effectiveness of the ICM, MMM, and the PCM should also address this question.
Helpful as well would be studies that compare the use of curriculum designed according to models intended primarily for gifted learners and curriculum designed according to exemplary models in general education. If, for example, a unit modeled after Wiggins and McTighe's (1998) Understanding by Design framework or Erickson's (2002) concept/process approach yielded achievement gains for gifted students, would gifted education endorse the model in addition to those conceived primarily for gifted learners? In order to determine general education's potential for meeting the needs of highly able learners, it is fair to judge the best curriculum models it has to offer against those from gifted education. Moreover, developing an interest in promising general education curriculum models would help gifted education assess the impact on high-achieving and high-potential students and would support the field in delineating ways in which the models could be used with varied populations of gifted learners.

Summary

In an educational climate where curriculum is being adversely affected by accountability measures, educators with an interest in highly able learners have reason to be encouraged by what key experts and organizations in general education say constitutes high-quality curriculum. Without exemplary core curriculum as a foundation, there is little hope for making meaningful curricular modifications for advanced students (Tomlinson et al., 2005). Gifted education's own standards for curricular excellence and models for developing good curriculum for high-ability learners hold tremendous promise for responding to calls that curriculum for all students be authentic, outcome-based, challenging, and relevant. Although neither field has yet reached the goal of adequately addressing highly able students' needs through curriculum, there is, ironically, greater agreement now in this age of standardization than ever before about how best to reach that aim.

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Common Core "Shifts"

Mathematics

The six shifts represent key areas of focus as teachers and administrators work to implement the Common Core State Standards for Mathematics (CCSSM). Oregon teachers are likely at different stages in practicing these shifts, however, establishing a statewide focus in these areas can help schools and districts develop a common understanding of what is needed in mathematics instruction as they move forward with implementation.

Shifts in Mathematics	
Shift 1: Focus	Teachers understand how the CCSSM emphasizes concepts prioritized in the standards so that time and energy spent in the math classroom is focused on critical concepts in a given grade. Students develop a strong foundational knowledge and deep conceptual understanding and are able to transfer mathematical skills and understanding across concepts and grades. (CCSSM, 2010, p.3-5; NMAP, 2008, p. 15-20)
Shift 2: Coherence	Principals and teachers carefully connect the learning within and across grades so that students can build new understanding onto foundations built in previous years. A teacher's strong understanding of learning progressions helps them monitor a student's progress and intervene in a timely basis. A student's understanding of learning progressions can help them recognize if they are on track and can enable them to productively take more responsibility for improving their skills. (NMAP, 2008, p.20-22 ; Mosher, 2011; CCSSM, 2010, p.4)
Shift 3: Procedural Fluency	Students are *efficient* and *accurate* in performing foundational computational procedures without always having to refer to tables and other aids. Teachers help students to study algorithms as "general procedures" so they can gain insights to the structure of mathematics (e.g. organization, patterns, predictability). Students are able to apply a variety of *appropriate* procedures *flexibly* as they solve problems. Helping students master key procedures will help them understand and manipulate more complex concepts in later grades. (NRC, 2001, p. 121; CCSSM, 2010, p.6)
Shift 4: Deep Conceptual Understanding	Deep conceptual understanding of core content at each grade is critical for student success in subsequent years. Students with conceptual understanding know more than isolated facts and methods - they understand why a mathematical idea is important and the contexts in which it is useful. Teachers take time to understand the Standards for Mathematical Practice that describe the student expertise needed to develop a deep conceptual understanding of mathematics. (NRC, 2001, p. 118; CCSSM, 2010, p. 4, 6-8)
Shift 5: Applications (Modeling)	Teachers at all grade levels identify opportunities for students to apply math concepts in "real world" situations. The process of modeling, that includes choosing and using appropriate mathematics and statistics to analyze and understand situations, is key in improving decisions as well as linking classroom mathematics and statistics to everyday life, work, and decision-making. Students are expected to use math and choose the appropriate mathematical models even when they are not prompted to do so. (NRC, 2001, p. 124; CCSSM, 2010, p. 72-73; NMAP, 2008, p.49-50)
Shift 6: Balanced Emphasis	Students need to both practice and understand mathematics. There is more than just a balance between these two priorities in the classroom – both are occurring with intensity. Teachers create opportunities for students to participate in authentic practice and make use of those skills through extended application of math concepts. The amount of time and energy spent practicing and understanding is driven by the specific mathematical concept and therefore, varies throughout a given school year. (NMAP, 2008, p.45-46; NRC, 2001, p.115)

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Common Core "Shifts"

English Language Arts & Literacy

There are six shifts that the Common Core State Standards (CCSS) **in ELA & Literacy in History/Social Studies, Science, and Technical Subjects** require of us if we are to be truly aligned with the CCSS in terms of curricular materials and classroom instruction.

Shifts in ELA / Literacy	
Shift 1: Increase Reading of Informational Text	Classrooms are places where students access the world – science, social studies, the arts and literature – through informational and literary text. In elementary, at least 50% of what students read is informational; in middle school, it is 55%; and by the end of high school, it is 70% (CCSS Introduction, p. 5). Increasing the amount of informational text students read K-12 will prepare them to read college and career-ready texts.
Shift 2: Text Complexity	In order to prepare students for the complexity of college and career-ready texts, each grade level requires growth in text complexity (Appendix A, pp. 5-17). Students read the central, grade-appropriate text around which instruction is centered (see exemplars and sample tasks, Appendix B). Teachers create more time in the curriculum for close and careful reading and provide appropriate and necessary supports to make the central text accessible to students reading below grade level.
Shift 3: Academic Vocabulary	Students constantly build the vocabulary they need to be able to access grade-level complex texts. By focusing strategically on comprehension of pivotal and commonly found words (such as "discourse," "generation," "theory," and "principled") teachers constantly build students' ability to access more complex texts across the content areas (Appendix A, pp.33-36).
Shift 4: Text-based Answers	Students have rich and rigorous conversations which are dependent on students reading a central text. Teachers ensure classroom experiences stay deeply connected to the text and that students develop habits for making evidentiary arguments based on the text, both in conversation as well as in writing, to assess their comprehension of a text (Appendix A, p. 2).
Shift 5: Increase Writing from Sources	Writing instruction emphasizes use of evidence to inform or to make an argument; it includes short, focused research projects K-12. Students K-12 develop college and career-ready skills through written arguments that respond to the ideas, events, facts, and arguments presented in the texts they listen to and read (Appendix A, pp. 24-26; student samples, Appendix C).
Shift 6: Literacy Instruction in all Content Areas	Content-area teachers emphasize reading and writing in their planning and instruction for teaching the content. Students learn through reading domain-specific texts in history/social studies, science, and technical subjects and by writing informative/explanatory and argumentative pieces (CCSS Introduction, p. 3).

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Common Core: Now What? Pages 24-27

Making the Shifts

Sandra Alberti

Here we are at the end of 2012. Who would have thought just three years ago that education would be in the position that it is in today—that 46 states, three U.S. territories, and the District of Columbia would have voluntarily agreed to share a set of standards for English language arts and literacy and mathematics? One would be hard-pressed to identify another initiative that has a greater potential to affect the teaching and learning that take place in so many classrooms across the United States. That being said, the widespread adoption of the Common Core State Standards has, to date, done little to change education. The adoption process itself was only the opening of the door.

So, here we are as U.S. educators, 46 states, thousands of districts, and millions of teachers, all with the task of implementing these standards. Over the last two years, I have talked with thousands of educators about the standards, and I have realized that one of the biggest risks we currently face is full-speed implementation without an understanding of the changes that the standards require. When a new reform initiative comes around, our instinct as teachers and education leaders is often to buy new tools to support the work. But in a time when the market is offering an enormous range of materials, educators need a secure understanding of the standards so that we can choose our resources wisely.

As we put the standards into practice, it is important to focus on a few shifts that have the most significant effect on students. These shifts should guide all aspects of implementing the standards—including professional development, assessment design, and curriculum. When educators attend to three core shifts in English language arts and literacy as well as in mathematics, the expectations for teaching and learning will be clear, consistent, and tightly aligned to the goals of the standards.

The English Language Arts and Literacy Standards

The English language arts and literacy standards include expectations in reading, writing, speaking, and listening that apply in English language arts classes as well as in science, social studies, and technical subjects. If all students are to be ready for college and career by the end of high school, it is not sufficient to solely address literacy skills; we must also consider the texts to which students apply these skills. The standards address lagging literacy performance with three key shifts.

1. Building Knowledge Through Content-Rich Nonfiction

Reading content-rich nonfiction in history, social studies, science, and the arts in elementary school is crucial for later reading growth and achievement. Students need to be grounded in information about the world around them if they are to develop the strong general knowledge and vocabulary they need to become successful readers. Nonfiction plays an important part in building students' knowledge about content.

In today's classrooms, however, a great amount of time and energy has been invested over the years in creating extended literacy blocks that often crowd out time for learning social studies and science. During these blocks, students overwhelmingly read stories; on average, fewer than 10 percent of elementary English language arts texts are nonfiction (Duke, 2004).

The shift to building knowledge from content-rich nonfiction does not mean disregarding literature. Literature plays an essential role in building students' reading skills and developing their love of reading. The standards celebrate the role literature plays in building knowledge and creativity in students. As teachers implement the standards, our students will need to read rich literature as well as content-rich nonfiction in elementary school.

In later grades, history, social studies, and science teachers will equip students with the skills needed to read and gain information from content-specific nonfiction texts. In middle school and high school, nonfiction texts are a powerful vehicle for learning content as students build skills in the careful reading of a variety of texts, such as primary documents in a social studies class or descriptions of scientific observations in a science class.

2. Reading and Writing Grounded in Evidence

The Common Core State Standards emphasize using evidence from texts to present careful analyses, well-defended claims, and clear information. Rather than asking students to respond to questions they can answer solely from prior knowledge or experience, the standards prioritize questions that require students to read texts with care. Quality text-based questions, unlike low-level "search and find" questions, require close reading and deep understanding of the text.

The standards also require narrative writing throughout the grades. Narrative writing enables students to develop a command of sequence and detail that is essential to the argumentative and informative writing emphasized in later grades. The standards' focus on evidence-based writing and speaking to inform and persuade is a significant shift from current typical practice. Today, the most popular forms of writing in K–12 draw from student experience and opinion, which alone will not prepare students for the demands of college and career.

3. Regular Practice with Complex Texts and Academic Language

The standards focus on text complexity because the ability to comprehend complex texts is the most significant factor differentiating college-ready from non-college-ready readers. To prepare students for college and career, the standards include a staircase of increasing complexity in assigned texts.

The complexity of a text is determined by a number of factors, including syntax and vocabulary. To understand complex materials, students need support in developing the key academic vocabulary common to those texts (ACT, 2008). These are words that commonly appear across genres and content areas and that are essential for understanding most informational text (for example, *ignite, commit*, and *dedicate*). This shift toward complex text requires practice, supported through deliberate close reading.

The Mathematics Standards

For years, reports about the declining U.S. performance in mathematics on international assessments have called for greater focus in mathematics education. The Trends in International Math and Science Study (TIMSS) and other international studies have concluded that mathematics education in the United States is "a mile wide and an inch deep" (Schmidt, McKnight, & Raizen, 1997). The United States has a coverage mentality in which students are exposed to a broad array of topics but rarely study a concept in depth.

In high-performing countries, the design principle for mathematics education is a deep focus on a few topics with coherent progressions between topics. Surveys suggest that postsecondary instructors value greater mastery of prerequisites over a shallow exposure to a wide swath of topics that have little obvious relevance to college-level work (Conley, Drummond, de Gonzalez, Rooseboom, & Stout, 2011).

The Common Core State Standards for mathematics incorporate recommendations for greater focus and coherence in mathematics education. Recent research by William Schmidt (see Gewertz, 2012) reveals that states that had prior standards most similar to the Common Core State Standards show significantly better results on the National Assessment of Educational Progress (NAEP).

Implementation of the mathematics standards requires much more than new names for old ways of teaching mathematics. Many well-intending educators are spending a great deal of time doing alignment studies to figure out which grade levels various topics have moved to. Quality implementation means more than shuffling topics around; it requires an understanding of three core shifts.

1. Greater Focus on Fewer Topics

Under the standards, instruction will need to go from a mile wide and an inch deep to much *less* wide and much *more* deep. Educators must significantly narrow the scope of content in each grade and deepen the time and energy spent on the following major topics:

- In grades K–2, concepts, skills, and problem solving related to addition and subtraction.
- In grades 3–5, concepts, skills, and problem solving related to multiplication and division of whole numbers and fractions.
- In grade 6, ratios and proportional relationships and early algebraic expressions and equations.
- In grade 7, ratios and proportional relationships and arithmetic of rational numbers.
- In grade 8, linear algebra.

This shift represents a rare occasion in education, when we talk about what we can *stop* doing instead of the more typical approach of adding yet one more thing to do. Unless we first create time and space for the priority areas in math, the potential to significantly improve mathematics education will pass us by.

2. Linking Topics and Thinking Across Grades

Mathematics is not a list of disconnected topics, tricks, or mnemonics; it is a coherent body of study made up of interconnected topics. The most important connections in the standards are vertical: The links from one grade to the next enable students to progress in their mathematical education.

It is crucial to think across grades and examine the progressions in the standards to see how major content develops over time. For example, in 4th grade, students must "apply and extend previous understandings of multiplication to multiply a fraction by a whole number" (Standard 4.NF.4). This extends to 5th grade, when students are expected to build on that skill to "apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction" (Standard 5.NF.4).

At a single grade level, educators can improve focus by tightly linking all topics to the major work of the grade. For example, in grade 3, bar graphs are not just another topic to cover. Rather, the standard about bar graphs asks students to use information presented in bar graphs to solve word problems using the four operations of arithmetic. Instead of allowing bar graphs to detract from the focus on arithmetic, the standards show how bar graphs can support that focus.

3. Rigorous Pursuit of Conceptual Understanding, Procedural Skill, and Application

Rigor in mathematics is not defined by making math harder or by introducing topics at earlier grades, as is commonly assumed. Rather, rigorous mathematics refers to a deep, authentic command of mathematical concepts. To help students meet the standards, educators will need to pursue, with equal intensity, three aspects of rigor in the major work of each grade: conceptual understanding, procedural skill and fluency, and application.

Each of these aspects of rigor has advocates. Some people like to stress fluency in computation, without acknowledging the role of conceptual understanding. Some like to stress conceptual understanding, without recognizing that fluency requires dedicated classroom work. Some people like to stress pure mathematics, without acknowledging that application can be highly motivating for students and that mathematical education should make students fit for more than just their next mathematics course. Some people like to stress application, without acknowledging that math doesn't teach itself. The standards do not take sides. Instead, they set high expectations for all three components of rigor.

Conceptual understanding. Once we have a focused set of standards, teachers and students have the time and space to develop solid conceptual understanding. There is less pressure to quickly teach students how to get the answer, which often means relying on tricks or mnemonics instead of understanding the reason an answer is correct or why a particular trick works.

For example, it is not sufficient for students to know they can find equivalent fractions by multiplying the numerator and denominator by the same number. Students also need to know why this procedure works and what the different equivalent forms mean. Attention to conceptual understanding helps students build on prior knowledge and create new knowledge to carry into future grades. It is difficult to build further math proficiency on a set of mnemonics or meaningless procedures.

Procedural skill and fluency. The standards require speed and accuracy in calculation. Teachers structure class time and homework in which students practice core functions, such as single-digit multiplication, so that they are more able to understand and manipulate more complex concepts. Developing procedural skill should not simply be memorization without understanding. It should be the outcome of a carefully planned learning progression.

We can't expect fluency to come naturally; we must address it specifically in the classroom and in our materials. Some students might require more practice than others, and there is no one way to develop speed and accuracy that will work for all students. All students, however, will need to develop a way to get there.

Application. This is the "why we learn math" piece, right? We learn it so we can use it in situations that require mathematical knowledge. There are requirements for application all the way through the grades in the standards. But correctly applying mathematical knowledge depends on solid conceptual knowledge and procedural fluency. If we attempt to get students to start solving real-world problems when they lack that knowledge and fluency, the problem will just become harder.

At the same time, we don't want to save all application for the end of the learning progression. Application can be motivational and interesting, and students at all levels need to connect the mathematics they are learning to the world around them.

Delivering on the Potential

The Common Core State Standards are built on the best of the state standards and learning expectations that preceded them. Unlike many state-level initiatives, however, the standards offer much more than a distribution of topics across the grades. They make it possible for us to deliver on a promise to our children that they will graduate prepared for college and career.

The standards cannot be seen as *one more thing* to put on our agenda. Instead, the standards must be integrated into our daily work in classrooms, schools, districts, and states. The shifts for English language arts and literacy and for mathematics reinforce the idea that a few things done well will have significant positive impact on our students. Let's focus on those few things together.

EL Online

For links to resources to help with the implementation of the Common Core English language arts and literacy standards, see the online-only article "The Common Core Standards: Starting Now" by David Liben and Meredith Liben.

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