



A VARIETY of formative and summative assessments are needed when appraising gifted students' learning and when differentiating the curriculum. These include standardized achievement and benchmark tests, portfolios, and product and performance assessments. Each has its purpose. Standardized achievement and benchmark tests are developed to measure the mastery of a particular set of knowledge and skills; portfolios generally include student work that assesses a student's progress and accomplishments in a given area; and product and performance assessments assess more complex thinking such as problem solving, creativity, and research.

Because most standardized assessments do not have enough ceiling to measure gifted students' growth (Ryser & Rambo-Hernandez, 2014) and do not have sufficient items to assess the depth of gifted students' learning (VanTassel-Baska, 2008), more and more educators are looking to other types of assessments to differentiate their curriculum and identify the effects of their instruction on gifted students' outcomes. These alternative assessments have been described as authentic and performance and/or product-based. Frey and Schmidt (2007) have further defined authentic assessments as the measure of ability on tasks that represent real-world problems and performance assessments as measures of skills or abilities. These researchers suggest that quality formative assessments should provide feedback to the teacher for the purpose of improving instruction, and feedback to students about their quality of learning. Therefore, assessments need to be aligned not only to above-level content standards but also to the quality of learning expected from gifted and talented students.

To identify effective methods for assessing advanced products and performance in gifted populations, this review included articles published since 2004 in *Gifted Child Today*, *Gifted Child Quarterly*, *Journal for the Education of the Gifted*, *Journal of Advanced Academics*, and *Roeper Review*. To be included, articles needed to examine the assessment of advanced products and performances in K–12 classrooms. Articles that included university-level assessments and studies conducted outside of the United States were excluded. Using these criteria, 16 articles were identified and summarized.

The type of articles found included empirical studies ($n = 11$) and recommendations for the development and implementation of performance and product assessments ($n = 5$). Populations studied were diverse and included elementary, middle, and high school students as well as teachers.

Advocates for alternative product and performance-based assessments suggest that students represent learning in multiple and creative ways (Duggan, 2007). Because most state assessments are developed for typical students, other types of assessments need to be used to assess student growth (Ryser & Rambo-Hernandez, 2014). These assessments need to be related to the learning outcome and include advanced, higher level thinking and open-ended problem-solving tasks that challenge gifted learners to demonstrate deep meaningful learning (Duggan,

2007; Kaplan, 2008; VanTassel-Baska, 2014). In addition, Kaplan (2008) suggested that the assessments represent authentic work of the discipline, extend the understanding of the subject matter, relate to the student's interests, foster personal and social goals, and reinforce the skills of both productivity and presentation.

A variety of instruments are useful when assessing advanced products and performances (Jolly & Kettler, 2004; Feng, VanTassel-Baska, Ouek, Bai, & O'Neill, 2004; Kim, Van Tassel-Baska, Bracken, Feng, & Stambaugh, 2014). Jolly and Kettler (2004) assessed leadership abilities through standardized instruments, self-assessment, peer-assessment, and adult observations. They reported a relationship between students' self-report of ability and the observations of others (Jolly & Kettler, 2004). Feng et al. (2004) were able to assess not only academic growth but also the students' views of the curriculum when using multiple assessments. In addition, researchers found that traditional assessments, such as standardized tests, were effective for measuring reasoning skills and content-area achievement but that nontraditional methods, such as performance-based assessments and tests of critical thinking, were needed to measure more complex thinking (Kim et al., 2014).

Including students in the assessment process was studied in three of the articles included in this review of the literature (Newman, 2004; Sriraman, 2004; Thompson & McDonald, 2007). Newman (2004) found that when students were involved in self-assessment during the creative process their products were of higher quality. Likewise, Sriraman (2004) discovered that when mathematically gifted students were asked to reflect upon and analyze their own thinking processes they were able to produce at a level characteristic of professional mathematicians. Being given the opportunity to create both assignments and assessments for their own products has also proven motivating to gifted learners (Thompson & McDonald, 2007). The most creative and expressive products resulted from student-constructed assignments.

An additional theme found in our examination of the product assessment literature was the evaluation of written products, which was discussed in three of the reviewed articles (Hall, 2007; Kaufman, Gentile, & Baer, 2005; Olthouse, Edmunds, & Sauder, 2014). The authors found that students use written products to reflect their ideas, identities, emotions, and intellectual understandings in

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one concrete package (Hall, 2007; Olthouse et al., 2014). In evaluating written products, researchers reported that creative writers rate student compositions similarly to experts in the field using the consensual assessment technique (Kaufman, Gentile, & Baer, 2005). This technique supports the practice of review, feedback, and collaboration in the writing process with gifted learners.

Product and performance assessments were used to show student growth in five intervention studies (Feng et al., 2004; Hertzog, 2007; Kim et al., 2014; Newman, 2004; Powers, 2008). Researchers (Feng et al., 2004; Kim et al., 2014) found that the use of the Integrated Curriculum Model (ICM) resulted in increases in grammar, persuasive writing, literary analysis and scientific content knowledge, concept mastery, and research skills. Newman (2004) reported that Talents Unlimited resulted in more highly rated, quality products than the control group. Moreover, Power (2008) found that independent study increased students' motivation and fostered critical thinking. On the other hand, Hertzog (2007) reported a number of internal and external barriers when implementing a project approach in two first-grade classrooms. These included the loss of control, development and implementation time, and district curriculum and state mandates. Administrative support therefore is crucial when implementing more problem- and project-based learning.

A review of the recent literature in the area of differentiated product and performance assessments suggests the need for establishing criteria for the evaluation of learning through student production. Many instruments and models have been established in the field of gifted education for the assessment of products and performances. When using these assessments, educators need to clarify the purpose or learning outcomes, target high-level

thinking, use multiple formats and approaches, involve students in the assessment process, align the learning activities with the learning outcomes, and carefully interpret the results when differentiating the curriculum for gifted students.

REFERENCE

VanTassel-Baska, J. L. (2008). *Alternative assessments with gifted and talented students*. Waco, TX: Prufrock Press.

Duggan, T. J. (2007). Ways of knowing: Exploring artistic representation of concepts. *Gifted Child Today*, 30(4), 56–63.

The author described three examples of using artistic representation of concepts across classroom curriculum—a ninth-grade science classroom, a South Dakota scholarship contest, and a summer program. In each of these examples, students were given the opportunity to choose a product from a list of creative representations such as photography, art, poetry, song lyrics, musical compositions, skits, posters, brochures, and films. The author suggested that when students demonstrated their understanding of concepts through creative products they increased their sense of agency and were able to teach the content to others. When deciding on content to use for artistic products, the author suggested that teachers use either specific text content or broad concepts and should ask themselves the following questions: (a) How many options do we currently give students to demonstrate their understanding of what they learn in school?, (b) How can we benefit from broadening the possibilities for the representation of concepts in the school setting?, (c) How do we foster and develop our students' creativity through our assignments and assessments?, (d) How can our students benefit from examining the different perspectives from which they encounter problems and develop

solutions?, (e) How can artistic representations of concepts promote collaboration between students?, and (f) What significant and specific benefits for gifted students may be gained from the process of representing school-encountered concepts artistically?

Feng, A. X., VanTassel-Baska, J., Quek, C., Bai, W., & O'Neill, B. (2004). A longitudinal assessment of gifted students' learning using the Integrated Curriculum Model (ICM): Impacts and perceptions of the William and Mary language arts and science curriculum. *Roeper Review*, 27, 78–83. doi:10.1080/02783190509554294

This mixed-methods study investigated the effects of implementing William & Mary's Integrated Curriculum Model (ICM) in science and language arts courses for gifted students. The sample included 973 gifted students from one northeastern suburban school district. Participants had been instructed using the ICM curriculum for 1 year (35%), 2 years (21%), or 3 years (44%) during third to fifth grade. Using pre- and postperformance-based assessments, participants' growth in language arts and science were examined. In grades 3–5, statistically significant gains were demonstrated in grammar, persuasive writing, literary analysis, and scientific research skills as measured by pre-post Diet Cola Test*, pre-post literary analysis instruments, and pre-post writing assessments. Performance data demonstrated steadily increasing academic growth from third to fifth grade with large effect sizes (from .52 to 1.38), which reflected its practical educational importance. Increasing achievement was demonstrated with repeated exposure over 2 to 3 years. Additional survey data collected from relevant stakeholders, including 367 parents, 110 educators, and 732 students, found that the majority of respondents viewed the curriculum as challenging, promoting peer interactions, and well organized. Limitations

from the research included a lack of a comparison group of gifted students within the school district. Since ongoing growth can be demonstrated by the use of assessments, suggestions for future research included replication studies and investigating of long-term outcomes on other standardized tests like the AP or SAT.

*The Diet Cola Test can be accessed at: <https://education.wm.edu/centers/cfge/curriculum/science/materials/index.php>

Frey, B. B., & Schmitt, V. L. (2007). Coming to terms with classroom assessment. *Journal of Advanced Academics*, 18, 402–423. doi:10.4219/jaa-2007-495

The authors of this article suggested that the difficulty of judging the theoretical benefit of modern assessment approaches, such as performance-based assessment, relates to the lack of common definitions of terms being used by researchers, advocates, and practitioners. Although researchers and teacher educators emphasize the importance of using performance-based assessment, authentic assessment, and formative assessment, teachers do not receive systematic training in using assessment strategies. This lack of training, as well as the absence of common definitions, makes it harder for teachers to apply the findings and recommendations of research to assessments in their classroom. After their review of the literature and a discussion of the differences in conceptualizing and using authentic and performance assessments, the

authors provided a summary of the literal definitions, components, formats, and intentions for authentic and performance assessments, and they suggest this categorization scheme:

- The purpose of performance assessment is to measure a skill or ability.
- The purpose of authentic assessment is to measure ability on tasks that represent real-world problems or tasks.
- Formative assessment should be used to provide feedback to the teacher to assess the quality of instruction or improve teaching behaviors.
- Assessment for learning should be used to provide feedback to students to assess the quality of learning and to improve learning behaviors.

Hall, H. R. (2007). Poetic expressions: Students of color express resiliency through metaphors and similes. *Journal of Advanced Academics*, 8, 216–244. doi:10.4219/jaa-2007-355

In order to study and unravel the multilayer nature of resilience among young men of color, this qualitative study used performance-based products. Through creative writing such as poetry, spoken word, and hip-hop rhymes, three teenage males were able to voice their individual realities and responses to their social and cultural worlds. The three adolescents in this study attended an all-boys program designed for students to talk about

their problems in a physically and psychologically safe environment. In one session, the topic of discussion was related to stereotypical images of people of color in society and in mass media. The students in the program showed increased engagement in group dialogues, which led the facilitator to ask the boys to bring a self-composed piece conveying their feelings towards the topic. According to the author, the students' writings were an interpretive design to better understand students' personal perspectives. However, to have a complete understanding of the students' mindset, additional data were collected through social interaction with the participants and non-structured interviews. The use of creative written expression provided a unique direction to develop awareness about the strategies and resources needed to assist the adolescent in facing negative psychological forces. The product of each of the young men illustrated his identity, contrary to the stereotypically portrayed image of being helpless and dysfunctional. The analysis showed that students used familial as well as non-familial resources, such as peers, mentors, or church activities, for support and reducing stressful moments. The author of this article highlighted the importance of using shared experiences as a source of understanding how youth of color utilize their skill and talents to be resilient.

Hertzog, N. B. (2007). Transporting pedagogy: Implementing the project approach in two



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first-grade classrooms. *Journal of Advanced Academics*, 18, 530–564. doi:10.4219/jaa-2007-559

In this qualitative case study, the author identified the issues and strengths of using a project-based approach in two first-grade, low-achieving classrooms. The project approach used in these two classrooms mirrored Renzulli's Type III enrichment, where students pursue answers to their own questions through three phases. In Phase I, children examine their prior knowledge and determine the areas in which they are most knowledgeable and the areas they need to learn more about. During the next phase, students do field work and collect data through different means such as observations, surveys, and interviews. After data analysis, students in Phase III will share their findings and new knowledge with parents, other students, and teachers. This instructional approach involves students in developing a variety of products including poems, songs, role-playing, drawings, or three-dimensional models. Throughout the academic year, the teachers implemented two enrichment projects. The author collected data using field notes, observations, interviews, and documents related to the teaching activities and student products. The data analysis showed that teachers faced external and internal barriers in implementing a project approach. Although the teachers perceived researchable questions in small group as authentic to learning, both teachers were worried about losing control of the topic and hence pursued the activities as a whole class. In addition, teachers found it hard to let students just work on their projects. In fact, they felt the need to teach them basic skills and provide constant support. Since a project-based approach to instruction requires at least 3 weeks, both teachers decided to implement only two projects, worrying that they could not cover the required curriculum with more projects. Furthermore, projects not only required more time but

also required more preparation time. Staying in compliance with the reward and punishment system required by school policies, both teachers realized that extrinsic rewards were in opposition to children being in charge of their learning as well as motivated to learn. For that reason, rewarding intrinsic values such as hard work, critical thinking, creativity, and independent work should be used during project-based approaches. Although both teachers believed that students learned more through projects, they expressed worries and difficulties in assessing students in meeting the district curriculum and state mandates.

Jolly, J., & Kettler, T. (2004). Authentic assessment of leadership in problem-solving groups. *Gifted Child Today*, 27(1), 32–39.

The purpose of this descriptive research was to ascertain observable behaviors to identify emergent leaders in problem-solving scenarios and to investigate if a relationship between these identified observable leadership behaviors and leadership self-reports existed. Participants included 83 identified gifted students in eighth through twelfth grades who attended Baylor University's Interdisciplinary Creative Problem Solving (CPS) Conference. At the onset, participants completed two leadership self-assessments* including one based on the Renzulli-Hartman Scales for Rating Behavioral Characteristics of Superior Students and another founded on the Gifted and Talented Evaluation Scales (GATES). After completion of the CPS process, participants and counselors recorded a member from their group who most exhibited each one of the 12 leadership behaviors outlined on the Leadership Observation Survey.* Observations obtained from students and adults reflected agreement on recognized group leaders. Although each emergent leader exhibited a greater number of leadership behaviors compared to the peers in the group, the

specific behaviors most attributed to the emergent leaders were the ability to: (a) keep their group focused, (b) offer compromises satisfactory to the group, (c) garner respect for his or her opinion, and (d) obtain frequent agreement from the group members. Half of the emergent leaders scored relatively higher on their self-assessments than their peers. Limitations of the research included lack of interrater reliability and observations that were limited only to the conference setting. The authors concluded that gifted leaders can be identified in a relatively short amount of time though observation of leadership characteristics. Expanded services to students gifted in leadership may be a resulting implication of this research.

*Both leadership self-assessments and the Leadership Observation Survey can be accessed at: <http://files.eric.ed.gov/fulltext/EJ682653.pdf>

Kaplan, S. N. (2008). Projects: Yay or nay. *Gifted Child Today*, 31(2), 47.

The author described criteria for designing project-based learning. She suggested the effectiveness of strategies used with gifted students should be based on practice rather than inclusion or omission of such activities. When designing projects that will act as products of learning, she recommends that teachers should ask themselves several guiding questions: Is the project aligned with standards and learning goals? Does it develop the potential of the learner? Do student explanations of their projects reflect deep learning? How can students define their role as well as the role of others in the creation of the project? The author suggested that projects used with gifted learners should (a) represent authentic work of the discipline; (b) reinforce established content standards; (c) support and extend understanding of the subject matter and mastery of skills; (d) relate to the student's academic and personal interests; (e) foster academic, personal, and social goals;

(f) reinforce the acquisition of the

skills of productivity as well as presentation skills, and (g) be displayed in a context that underscores their relevance for students and their academic contributions.

Kaufman, J. C., Gentile, C. A., & Baer, J. (2005). Do gifted student writers and creative writing experts rate creativity the same way? *Gifted Child Quarterly*, 49, 260–265. doi:10.1177/001698620504900307

This study was conducted using the consensual assessment technique where an expert in the field rates the work of an individual. The authors were interested in seeing whether or not the ratings given by gifted writers were similar to those given by creative writing experts. A sample of 27 short stories and 28 poems were drawn from the 1998 National Assessment of Educational Progress (NAEP) Classroom Writing Study for evaluation. Raters participating in this study included eight gifted creative writers, all juniors in high school, from the New Jersey Governor's School of the Arts and 13 expert judges. Experts represented middle school teachers ($N = 4$), published creative writers ($N = 4$), and psychologists in the field of creativity ($N = 5$). Raters were asked to read the short stories and poems and assign them a rating of 1 to 6 with 1 being the lowest level of creativity and 6 being the highest. Participants were asked to assign ratings based on their own personal definition of creativity. The authors found that ratings reported within and across both groups were closely related to each other, meaning that novices and experts rated the writing similarly. Using this information, the authors suggested that evaluations of creativity by gifted novices in a field may be similar to evaluations given by experts. They also suggested that the findings of this study supported the use and benefits of peer review, feedback, and collaboration between gifted writers in the classroom.

Kim, K. H., VanTassel-Baska, J., Bracken, B. A., Feng, A., & Stambaugh, T. (2014). Assessing science reasoning and conceptual understanding in the primary grades using standardized and performance-based assessments. *Journal of Advanced Academics*, 25, 47–66. doi:10.1177/1932202X14520946

In this study, the authors examined (a) whether the use of the Integrated Curriculum Model (ICM) with students increased their science content knowledge and reasoning and (b) whether the use of ICM increased content and concept mastery in science as measured by pre-post Performance Based Assessment (PBA). Schools were assigned randomly to experimental and comparison groups. The experimental group included 250 students who received instruction in the ICM for 2 years, participated in the PBA for 2 years, and took the first and second year follow-up post-achievement tests. The units in the curriculum intervention aimed at developing an understanding of macro-concepts, scientific reasoning, and investigative skills. In addition, the unit content was aligned with the national and state standards. Teachers who were implementing ICM were trained in the teaching models used in the unit, science content, concept development, and assessments. Both standardized tests and nontraditional assessments were used to assess the learning of students. The Metropolitan Achievement Test was used as standardized measure of science achievement, the Test of Critical Thinking was used as a measure of critical thinking, and PBA was used to assess conceptual understanding and content attainment. Conceptual understanding was shown in students' responses to open-ended question including examples, features of macro-concepts, and generalization. Content attainment was shown in student's drawing of concept maps about the topics being studied. The findings

of the study showed that the use of ICM increased all students' learning in concepts and content. Using the PBA the analysis further showed that ICM has benefits for all students, regardless of their initial achievement level, gender, and ethnicity. The authors explained that the reasoning skills and science achievement could be measured by using standardized tests, however, the more advanced, complex science concepts and content needed PBA to be measured. Hence, measuring student learning should be conducted using both traditional and non-traditional assessment.

Newman, J. L. (2004). Talents and Type IIIs: The effects of the Talents Unlimited Model on creative productivity in gifted youngsters. *Roeper Review*, 27, 84–90. doi:10.1080/02783190509554295

The purpose of this quasi-experimental study was to determine if instruction using the Talents Unlimited Model would affect the quality and quantity of completed Type III products, which are produced for an authentic audience to address a real-world problem. Research participants included 147 students in third to sixth grade from three Birmingham, AL, suburban school districts. Cluster sampling was used to randomize students and teachers by schools into the treatment or control groups. Students in the treatment group ($n = 59$) received Talents Unlimited instruction, and control group students ($n = 45$) were instructed using Renzulli's Schoolwide Enrichment Model. Each completed Type III products. The quality of the products were measured using the Student Product Assessment Form (SPAF)* of the Schoolwide Enrichment Model that assesses 15 factors related to the product, problem-solving process, and content on a Likert-scale from 1 to 5, resulting in a maximum score of 75. The experimental group's products were more highly rated than the control group's products overall

($M = 63$ vs. $M = 53$) and had higher average quality ratings on each individual factor. Statistically significant differences were also reported in the number of finished Type III products as well as specific measures of statement of purpose, problem focusing, logical sequence, audience, originality, beyond grade-level quality, attention to detail, demonstrated effort, and advanced subject familiarity. Most participants (87%) in the treatment group reported that they “maybe improved” or “definitely improved” on all six areas listed on the questionnaire. In conclusion, the researchers asserted that educators have the responsibility to provide students with opportunities and instructional guidance in integrating real-world products for authentic audiences so that students can foster research inquiry, problem identification, implementation management, presentation, and evaluation skills.

*The Student Product Assessment Form (SPAF) can be accessed at: <http://www.gifted.uconn.edu/sem/pdf/spaf.pdf>

Olthouse, J. M., Edmunds, A. L., & Sauder, A. E. (2014). School stories: How do exemplary teen writers portray academics? *Roeper Review*, 36, 168–177. doi:10.1080/002783193.2014.919622

In this study, 23 creative writings by talented writers were analyzed to identify their everyday school experience and academic identity. According to the authors, creative writing is viewed as fabricated, but captures the tone, voice, and metaphor of the writers. For that reason, hermeneutic inquiry was used in which the researchers explored the meanings in the words, expression, and metaphors that talented writers used in their products. With this approach to analysis, the researchers felt that they honored the role of the writer and captured a more authentic perspective. Using this methodology the researchers found four emerging themes across the writings: competition, intellectualism, geekdom, and detachment.

In the stories and poems, detachment from teachers and curriculum were depicted showing that the relevance of academic content is dependent on the students’ proactive involvement with the content. The authors suggested that teachers need to identify ways of connecting students’ personal values and experiences with the content. In addition, the findings showed that the school should be a place where talent is celebrated instead of a place where one’s abilities need to be hidden. The struggle between academic achievement and social acceptance needs to be addressed by counselors. In addition, academic competition may have negative consequences and may be more positive when individuals compete against their own standards. According to the authors, the written products were tools that reflected ideas, identity, emotions, and intellect in one concrete package.

Powers, E. A. (2008). The use of independent study as a viable differentiation technique for gifted learners in the regular classroom. *Gifted Child Today*, 31(3), 57–65.

Researchers in this study addressed the following questions: Does the use of independent study foster motivation and achievement for gifted students? Does student choice motivate student participation and achievement in independent study? How does the partnership of social studies and real-world tasks motivate historical thinking and achievement? While a group of 20 gifted seventh graders were chosen to participate in independent studies tied to inventions in social studies, 16 finished their projects. The independent study (IS) was designed using the Powers Plan, which included the steps of preparation, planning, probing, product, presentation, and portfolio. Students spent time researching inventions throughout history and then creating their own invention that would solve a problem existing now or in the future. Students used

a notebook to collect their research findings, reflections, and ideas during the IS process and presented their invention along with a PowerPoint at the end of the unit. Students were graded on their IS using a rubric and then participated in an interview and responded to a questionnaire about the IS process. The author found that students (a) valued the freedom of choice given to them through the IS process, (b) understood the topic to a greater depth, and (c) enjoyed participating in what felt like real-world tasks. Data from the interviews and questionnaires showed that all students were motivated (and challenged) by the IS experience and all said they would like to do it again. Teachers involved in the study said that IS fostered critical thinking skills, provided personal choice and subject depth, and allowed students to use research and computer skills that they would not otherwise have the opportunity to develop.

Ryser, G. R., & Rambo-Hernandez, K. E. (2014). Using growth models to measure school performance: Implications for gifted learners. *Gifted Child Today*, 37(1), 17–23.

The current focus on high-stakes testing has led to an accountability movement in American education. Assessment data and growth modeling are used to measure student academic growth and to show adequate yearly progress (AYP). The problem with most current growth models is that they are designed for measuring proficiency in typically developing children, not gifted learners. The authors discussed the introduction of the No Child Left Behind Growth Model Pilot Program (GMPP) in 2001, which used status models to demonstrate AYP. These models looked at a school’s overall level of student proficiency at one point in time but failed to recognize improvement in individual scores. In 2005, the GMPP was modified to include multiple growth models including transition models, trajectory models, and projection mod-

els. Current growth model practices are expanding to include more than just proficiency measures. Interpretations of growth models now includes growth description (magnitude of growth), growth prediction (future scores), and value-added (causes of growth). The authors stressed that different growth models answer different questions so no single model gives “best results.” More statistically sound growth models are needed to accurately assess gifted students. Criteria for statistically sound growth models include (a) at least three observations or test scores, (b) comparable scores across time, and (c) measures of time for every test administration. In using growth models with gifted learners, educators need to be aware that assessments intended to measure proficiency in typically developing students will contain (a) error when used with gifted students, (b) ceiling effects, and (c) regression to the mean. The authors suggested the use of above-level and computer-adaptive testing options for gifted learners.

Sriraman, B. (2004). Gifted ninth graders' notions of proof: Investigating parallels in approaches of mathematically gifted students and professional mathematicians. *Journal for the Education of the Gifted*, 27, 267–292. doi:10.4219/jeg-2004-317

In this study four mathematically gifted freshman were given the open-ended “Circumscribing a Triangle Problem” and asked to prove their answers. The author conducted one-hour clinical interviews with the students to document their thinking processes and compare them to those of professional mathematicians. Through the analysis of student work, interview transcripts, and the author's personal notes, four themes emerged that were similar across all four of the students' mathematical thinking: visualization, intuition, empiricism (measurement and concrete examples), and reversibility—all of these

characteristics are paramount to the work of mathematicians at a professional level. These findings suggest that mathematically gifted students have the potential to think and reason similarly to professionals within the field. Classroom teachers should be aware of the learning process and allow for inductive learning of mathematics for gifted learners rather than solely delivering content using deductive methods.

Thompson, D. D., & McDonald, D. M. (2007). Examining the influence of teacher-constructed and student-constructed assignments on the achievement patterns of gifted and advanced sixth-grade students. *Journal for the Education of the Gifted*, 31, 198–226. doi:10.4219/jeg-2007-676

A teacher-researcher team, using

descriptive case study/action research, examined differences in preference and achievement between teacher-constructed and student-constructed assignments and assessments. Sixth-grade participants included 53 students (25 gifted and 29 advanced) in a gifted and talented program at a southwest suburban school. Of these, the teacher identified 15 underachievers (8 gifted and 7 advanced) by comparing academic grades, standardized test scores, and observed student potential. The teacher-created assignment* (and assessment rubric*) allowed a student to select from three different prompts to write an essay on *Jacob Have I Loved* by Katherine Paterson. Subsequently, students were given an opportunity to design their own project and create an assessment to measure their achievement. Data collected from written open-ended questionnaires illuminated



student preferences and decision-making. Students appreciated flexibility in choosing an essay prompt but selected their topic based on various motivations: underachievers considered the ease; achievers picked the one expected to earn the highest grade; and gifted students generally made personal connection when selecting the topic.

Students overwhelmingly preferred the student-constructed assignment. Underachievers also favored creating their own assessment, but the achievers were equally divided on their preference of student- or teacher-created assessment. With respect to quality of products, the most creative and expressive products resulted from the student-constructed assignment. Limitations of the study included: the number of participants, the lack of previous historical participant data, the single subject (language arts), the particular novel, the choice of an essay as the teacher-constructed project, and the limited measurement of two assignments. Research implications for teacher-practitioners suggest that underachieving behaviors may be reduced by allowing students greater input in selection of products and assessment criteria to demonstrate learning as well as optimizing their motivation and achievement for they are best resource for “generating optimal, authentic, and meaningful learning” (p. 217).

*The appendices of the article include the: teacher-created essay prompts, teacher-created assessment rubric, student-created assignment instructions, and self-reflection questions.

VanTassel-Baska, J. (2014). Performance-based assessment: The road to authentic learning for the gifted. *Gifted Child Today*, 37(1), 41–47. doi:10.1177/1076217513509618

This article outlined the need for performance-based assessment (PBA). The author suggested that PBA can be used as a diagnostic tool in identifying what curriculum should be taught and/or which students to

place in the various flexible-grouping clusters. They can also be used to assess higher order thinking skills and project-based curriculum. Teachers may use assessment data reflectively because a high score on a performance assessment points to a high-functioning classroom environment. When designing performance-based assessments, educators should clarify the purpose; target high-level skills such as deduction, induction, problem solving, decision-making, and invention; use multiple approaches; and carefully consider the use of assessment results. Teachers may choose to use or modify existing assessments such as The Diet Cola Test*, International Baccalaureate assessments, and AP exams* or refer to the National Association for Gifted Children Common Core State Standards guidebooks for additional prototypes. The author concluded that performance-based formative and summative assessments are indispensable in all subject domains because they provide a comprehensive understanding of student performance capability and evidence of ongoing academic growth.

*AP exam sample free-response questions can be found at www.collegeboard.com and The Diet Cola Test can be accessed at: <https://education.wm.edu/centers/cfge/curriculum/science/materials/index.php>

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