

Research Related to the Schoolwide Enrichment Triad Model

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Abstract

The Schoolwide Enrichment Triad Model¹ (SEM) is a product of 15 years of research and field testing combines the previously developed Enrichment Triad and Revolving Door Identification Models. SEM has been implemented in school districts worldwide, and extensive evaluations and research studies indicate the effectiveness of the model. In this article, a brief explanation, of SEM is provided as a summary of the research conducted on this approach. The review of the research is subdivided into (a) the effectiveness of the model as perceived by key groups, (b) research related to creative productivity, (c) research relating to personal and social development, (d) the use of SEM with underserved populations, (e) research on self-efficacy, (f) the use of SEM as a curricular framework, (g) research relating to learning styles and curriculum compacting, and (h) longitudinal research on the SEM. Research suggests that the model is effective at serving high-ability students in a variety of educational settings and in schools that serve diverse ethnic and socioeconomic populations.

Programs based on enrichment models and enrichment activities are the most commonly used approach in gifted education. However, options based on enrichment are not as well supported by research as are programs based on acceleration. Research on acceleration has provided Strong support for the benefits of acceleration in the area of mathematics; and the objectivity of the variables being examined (e.g., math grades and math performance) has enabled researchers to use powerful quantitative research designs. Research on variables associated with enrichment, on the other hand, usually examine more complex student outcomes such as creativity, the quality of student products, and the influence of process-training activities on subsequent applications to real world problems.

A growing number of quantitative and qualitative studies provide information about the effectiveness of various kinds of enrichment activities. The purpose of this article is to summarize a series of studies that have examined various aspects of one specific enrichment model. Following a brief description of the Schoolwide Enrichment Triad Model, a summary of research dealing with eight categorical components of the model will be presented. These components include: the effectiveness of the model, creative productivity, personal and social development, underserved populations, self-efficacy, SEM as a curricular framework, research relating to learning styles and curriculum compacting and longitudinal research on the model.

The Schoolwide Enrichment Triad Model (SEM)

The Schoolwide Enrichment Triad Model (SEM) evolved after 15 years of research and field testing by both educators and researchers (Renzulli, 1988). It combined the previously developed Enrichment Triad Model (Renzulli, 1977) with a more flexible approach to identifying high-potential students called the Revolving Door Identification Model (Renzulli, Reis, & Smith, 1981). This

combination of services was initially field tested in 11 school districts of various types (rural, suburban, and urban) and sizes. Research studies were conducted which indicated positive growth for students, even those who were not identified for gifted program services (Reis, 1981). These and other field tests resulted in the development of the SEM (Renzulli & Reis, 1985), which has been widely adopted throughout the country. Although separate studies on the model have been documented based on field tests in schools with widely differing socioeconomic levels and program organizational patterns (Cooper, 1983; Olenchak, 1988; Olenchak & Renzulli, 1989; Reis, 1981), the research on the SEM has not to date been considered in its entirety.

Putting the Research to Use

Administrators, teachers, and parents are often interested in research about the effectiveness of various gifted program interventions. Research on the benefits of various types of acceleration has been widely disseminated, but research on the effectiveness of various other types of gifted programs has been less widely reported because of the difficulty of measuring outcomes such as creative productivity, and increases in affective processes such as leadership, self-concept, and self-directed learning. The numerous research studies summarized in this article indicate the effectiveness of the Schoolwide Enrichment Model. In studies of numerous components of the SEM, research studies provide proof of the usefulness of the model with various populations in various types of settings.

Field-based educational research faces numerous limitations: thus the following review is offered with a cautionary note. These limitations are further elaborated upon in the conclusion of this article. In addition, it should be noted that only one comparative study (Heal, 1989) was completed comparing the effects of SEM to other enrichment models or strategies. Other studies do report results using within-model comparisons (Delisle, 1981; Reis, 1981) or the SEM program as compared to no intervention (Karafelis, 1986; Starko, 1986). Because control or comparison groups of students participating in alternate enrichment models are not used, it is difficult to attribute various results to participation in the SEM. Accordingly, alternate explanations may exist for some of the findings presented in this manuscript. However, the generally positive conclusions about the SEM with which we summarize the article are drawn from the series of research studies reported, the relatively large samples involved in some of the studies, and the practice of a large team of researchers to use designs which attempt to control for the many factors influencing educational research.

Services Provided in the SEM

In the SEM, a talent pool of 15%-20% of above-average ability/high-potential students is identified through a variety of measures, including achievement tests, teacher nominations, assessment of potential for creativity and task commitment, as well as alternative pathways of entrance (self-nomination, parent nomination, etc.). High achievement test and IQ test scores automatically include a student in the talent pool, enabling those students who are underachieving in their academic school work to be included.

Once students are identified for the talent pool, they are eligible for several kinds of services. First, interest and learning styles assessments are used with talent pool students. Informal and formal methods are used to create or identify students' interests and to encourage students further to develop and pursue these interests in various ways. Learning style preferences assessed include projects, independent study, teaching games, simulations, peer teaching, programmed instruction, lecture, drill and recitation, and discussion. Second, curriculum compacting is provided to all eligible students; that is, the regular curriculum is modified by eliminating portions of previously mastered content. This elimination or streamlining of curriculum enables above-average students to avoid repetition of previously mastered work and guarantees mastery while simultaneously finding time for more appropriately challenging activities (Reis, Bums, & Renzulli, 1992; Renzulli, Smith, & Reis, 1982). A form, entitled the Compactor (Renzulli & Smith '1978a), is used to document which content areas have been compacted and what alternative work has been substituted. Third, the Enrichment

Triad Model offers three types of enrichment experiences. Type I, II, and III Enrichment are offered to all students; however, Type III Enrichment is usually more appropriate for students with higher levels of ability, interest, and task commitment.

Type I Enrichment consists of general exploratory experiences such as guest speakers, field trips, demonstrations, interest centers, and the use of audiovisual materials designed to expose students to new and exciting topics, ideas, and fields of knowledge not ordinarily covered in the regular curriculum. Type II Enrichment includes instructional methods and materials purposefully designed to promote the development of thinking, feeling, research, communication, and methodological processes. Type II training, usually carried out both in classrooms and in enrichment programs, includes the development of (a) creative thinking and problem solving, critical thinking, and affective processes; (b) a wide variety of specific learning-how-to-learn skills; (c) skills in the appropriate use of advanced-level reference materials; and (d) written, oral, and visual communication skills.

Type III Enrichment is the most advanced level in the Enrichment Triad Model. Although Types I and II Enrichment and curriculum compacting should be provided on a regular basis to talent pool students, the ability to revolve into Type III Enrichment depends on an individual's interests, motivation, and desire to pursue advanced level study. Type III Enrichment is defined as investigative activities and artistic productions in which the learner assumes the role of a first-hand inquirer thinking, feeling, and acting like a practicing professional, with involvement pursued at as advanced or professional level as possible given the student's level of development and age. The most important feature of the model is the "flow" or connection among the experiences. Each type of enrichment is viewed as a component part of a holistic process that blends present or newly developed interests (Type I) and advanced level thinking and research skills (Type II) with application situations based on the *modus operandi* of the first-hand inquirer (Type III).

Effectiveness as Perceived by Elementary Students, Parents, Teachers, and Administrators

Three researchers have examined the effectiveness of the SEM as it relates to elementary school children, parents, teachers, and administrators. Reis (1981) analyzed the responses from questionnaires and interviews and prepared separate reports for each of eleven participating school districts in the northeast that represented a wide variety of communities including urban, suburban, and rural. The data gathered from classroom teachers, administrators, students in the talent pools, and their parents indicated that feelings about the SEM program were generally positive. Many classroom teachers reported that their high level of involvement in the program had favorably influenced their teaching practices. Parents whose children had been placed previously in traditional programs for the gifted did not differ in their opinions about the program from parents whose children had been identified as gifted under the expanded SEM criteria. Resource teachers, many of whom had been involved previously in traditional programs for the gifted, overwhelmingly preferred the revolving door identification procedure to the traditional reliance on test scores alone.

Olenchak (1988) investigated the use of the SEM as a plan for applying some of the methods and instructional strategies of gifted education to the overall process of schoolwide change in 18 elementary schools in six states. Specific emphasis was placed on the effects of SEM on both teacher attitudes toward their work, student attitudes toward learning, and on general changes in behavior among school administrators, parents, teachers, and students. The first study, a quantitative and qualitative examination of SEM's effects on teacher attitudes toward their profession ($n=236$), revealed statistically significant ($p<.001$) positive changes when the intervening variables of grade level, gender, years of experience, years of training, and schoolwide aspects of discipline, administrative leadership styles, and conflict resolution were controlled. Interview data ($n=66$) enhanced these results with statistically significant ($p<.001$) improvements in teacher attitudes toward education of the gifted. Similarly, when student attitudes toward learning were examined ($n=1,698$), with the intervening variables of grade, teacher, classroom climate, and teaching style controlled, statistically significant positive changes ($p<.01$) resulted. Student interviews ($n=120$)

likewise showed statistically significant ($p < .001$) improvement toward gifted education and its various components. The study also resulted in statistically significant ($p < .001$) improved attitudes toward gifted education among parents of both gifted and nongifted students and among school principals. Student creative productivity was also studied, and students were found to pursue individual and small group investigations with a high percentage of completion that resulted in Type III products of exceptionally high quality. In addition, this study produced a model for implementation of SEM through a structured series of training sessions aimed at the various client groups whom the program would ultimately influence: teachers, administrators, parents, school staff, and students (Olenchak, 1988; Olenchak & Renzulli, 1989).

Cooper (1983) also investigated administrators' attitudes towards SEM by examining the attitudes of superintendents, principals, and special education/pupil personnel directors in eight districts using the SEM. Multi-site case studies were used to gather both quantitative and qualitative data in investigating the following four research questions:

1. What types of information do administrators need to make decisions about the efficacy of gifted programs?
2. What are the service delivery goals (content, methodology, outcomes) of enrichment-based gifted programs?
3. What are the indicators of how well the gifted program fits into the total school curriculum?
4. How flexible is the Schoolwide Enrichment Model in accommodating local needs and resources?

The Key Features Evaluation Model (Renzulli, 1975) was used to organize data collection from the 32 administrators involved in the study. The tools used for data collection included annual and monthly reports, questionnaires, interviews, rating scales, program documents (such as curriculum compactor forms and management plans for Type III projects), and program plans submitted to the State Department of Education. Data from administrator and teacher interviews were triangulated with data obtained from classroom observations and an examination of 10 program records which were requested from each district.

Coopers' findings underscore the importance of administrators' knowledge of and involvement in effective programs and revealed the impact of SEM on all students. Several administrators reported comments about the effectiveness of the SEM, including:

[The model] is a sharing program with the rest of the school. It has more impact academically as a sharing program with other classes than any other program I've seen. [It is] a strong plus... [when] the administrator sees the building operating as a unit.

Indicators of how well the gifted program had been integrated into the total school curriculum were of a political and economic nature. Political advantages of the Schoolwide Enrichment Model included greater staff involvement in gifted children's total education; more positive staff attitudes toward the gifted program; fewer concerns about identification; positive changes in how guidance counselors worked with students; more excitement about teaching in general; more incentives for students to strive for higher goals through modeling (students were now eager to pursue topics of great personal interest to them even though they hadn't been identified formally for the gifted program); and a better quality of life for both students and staff.

Research Relating to Creative Productivity

Reis (1981), Gubbins (1982), Burns (1987), and Newman (1991) studied the effects of different types of training programs on students' ability to initiate and/or complete Type III study, and Delcourt (1988) and Starko (1986) investigated various components of the process of creative productivity.

Research Relating to the Quality or Noncompletion of Products

Reis (1981) analyzed the quality of products completed by students involved in a SEM program using the Revolving Door Identification Model. The population for the study consisted of 1,162 students in grades 1 through 6; they came from 11 school districts—some rural, some suburban, some urban—and represented a variety of ethnic backgrounds. The 11 participating school districts used the flexible identification procedures to select students for their talent pools comprising 15% to 25% of the general student population.

The talent pools in each district and at each grade level were divided into two groups for purposes of data analysis. The first group (Group A) consisted of students who scored in the top 5% on standardized tests of intelligence or achievement. These students would have been identified for placement in a gifted program by traditional guidelines; in fact, most members of this group had already been enrolled in such programs in previous years. The second group (Group B) consisted of students whose abilities were well above average but who scored below the top 5% on standardized tests and, therefore, would not have been eligible under traditional guidelines for special services. Students in this group entered gifted programs in their respective schools under the expanded entry criteria of the revolving door model. Both groups participated equally in all program activities. Reis examined the following two research questions:

1. To what extent and in what manner do the age and sex of talent pool students affect the frequency in the process of “revolving in” to the resource room to engage in advanced level investigations?
2. Is there a significant difference in the quality of products completed by male and female students in a gifted program who would have been identified according to traditional guidelines (the top 1-5% as usually selected by high scores on group achievement or IQ tests) and those male and female students eligible for inclusion under the broadened guidelines of the Schoolwide Enrichment Model?

Reis found that a significantly higher proportion of females completed advanced level products than males. She also found that a significantly higher proportion of fourth through sixth grade students completed products than the first through third grade students. Analysis of variance procedures were carried out to determine if a significant difference existed in the quality of products completed by male and female students in a gifted program who would have been traditionally identified (the top 5%) and those male and female students eligible for inclusion under the expanded guidelines of the SEM (the next 15-20%). The quality of products completed by students was assessed by their resource teachers through the use of the *Student Product Assessment Form* (Reis, 1981). This instrument provides individual ratings for eight specific qualitative characteristics of products and for seven factors related to overall product quality. The validity and reliability were established through a yearlong series of studies, using a technique developed by Ebel. Levels of agreement among raters on individual items of the scale ranged from 86.4% to 100%. By having a group of raters assess the same set of products twice, with a period of time between ratings, we established a reliability coefficient of .96 for the instrument.

As presented in Table 1, an analysis of variance of these data revealed that, as assessed by resource teachers using the *Student Product Assessment Form*, the quality of products completed by students in the two groups was indistinguishable on every individual key concept and on the total of all items ($p < .08$). In fact, the mean score of the total of all of the key concepts was slightly higher for students who would not have been identified (Group B) and therefore, would not have participated in the traditional gifted program in their district.

Table 1

Group Differences on the Quality of Advanced-Level Products Completed by Talent Pool Students

An analysis of variance was also carried out to determine if a significant difference existed in the quality of products completed by males and females. An analysis of variance on these data revealed that no significant difference was found between males and females in sub-totals 1-8, 9A-G, or in the total of all of the key concepts (1-9G) on the *Student Product Assessment Form*. An analysis of variance procedure on these data also revealed that interactions between sex and group with respect to the quality of products existed for the total of the key concepts. The interaction of the total of items 1-9G on the *Student Product Assessment Form* shows that the highest product quality ratings were found for females who were traditionally identified (usually the top 5%) and for males who were identified under the expanded guidelines of the SEM (next 15-20%). Follow-up t-tests were used to examine differences between groups within each of the respective sexes. When the total of all of the Key Concepts was examined, no significant differences were found between males and females in Group A and males and females in Group B. The findings of this research indicate that programs for the gifted that rely on traditional identification procedures may not be serving the wrong students, but they are certainly excluding large numbers of above average pupils who, given the opportunity, are capable of producing equally good products.

Gubbins (1982) investigated the use of the model to: (1) to determine whether the constructs of achievement, academic self-concept, and locus of control were correlates of creative/productive behavior; (2) to identify factors that explain why certain students did not engage in product development; and (3) to examine factors associated with the non-completion of a product. The *Self-Appraisal Inventory* (Instructional Objectives Exchange, 1972) and the *Intellectual Achievement Responsibility Questionnaire* (Crandall, Katkovsky, & Crandall, 1965), measuring academic self-concept and locus of control, respectively, were administered to students in grades 4-6. These data, along with achievement test scores, were entered into a series of step-wise multiple regression procedures to assess their impact on the criterion of product development. Data analyses indicated that academic self-concept was a significant predictor. However, this variable accounted for only 3-6% of the variance. Relative to the second purpose, several findings resulted from questionnaire data obtained from students who did not initiate products: (a) Approximately 15% of this group was not involved in preliminary activities based on the Enrichment Triad Model; (b) Those who were involved in enrichment activities experienced Type I activities in science and social studies and Type II training in creative and critical thinking; and (c) The lack of product development was related to the difficulty in generating product ideas and to time management.

Finally, the study centered on the approximately 50% of eligible talent pool students who did not choose to do a project. Overall, it was concluded that the regression results were of negligible value in uncovering the correlates of creative production. However, the results of the questionnaire and interview data were significant in revealing factors critical to the implementation of a model focusing on the creative/productive behavior of gifted students. Of particular interest in this study was Gubbins' analysis of students who did not develop products (345 of 775) or those students who started products but did not complete them (7 of 430). Sixty-one percent of the students who did not develop a product indicated that they did not have an idea for what they might study. Forty-five percent of the students indicated that they would have to make up classwork that they missed and a nearly identical percentage (44%) indicated that they had a full schedule in school. The remarkably low percentage of non-completers is also indicative of the enjoyment most students had in the completion of their products. A review of the trends and patterns in the response data disclosed four factors that interfered with the product completion: interest level, task commitment, time commitment, and human and material resources (Gubbins, 1982).

Reis (1981) and Gubbins (1982) found that approximately 40-50% of identified talent pool students in new SEM programs do not choose to participate in the Type III investigations described earlier. Although personal variables can account for some of the variation in students' decisions to begin such projects, these two researchers have speculated that programming practices may account for a larger portion of this variance. Both researchers suggested two practices that might increase student participation in the Type III component of the Enrichment Triad Model. First, they suggested that

more teachers should provide curriculum compacting within the regular classroom to provide more time for Type III projects. Second, they suggested that teachers of the gifted might provide above average ability students with Type II training units that were specifically designed to teach students how to identify their interests, find problems, and develop a research design or problem solving paradigm.

The Effects of Training on Type III Products

Burns (1987) and Newman (1991) investigated the use of different training programs on participation in Type III studies. Burns (1986) compared the effects of Type II training (in how to focus and manage a Type III project) and additional personal and environmental variables on 515 students' decisions to initiate problem solving investigations (Type IIIs) in new SEM programs. Forty-eight groups of above average ability students in grades 3-8 were randomly assigned to either comparison or experimental groups. Students in the treatment group received seven Type II lessons in how to organize a Type III investigation. Students in the comparison group received Type I experiences or Type II training in one of the other sets of skills within Renzulli's Type II taxonomy. The initiation of a Type III investigation was used as the dependent variable in the study. Personal variables and participation in either the treatment or the control group were entered into a hierarchical discriminant function analysis to identify the strength of the treatment beyond the personal variables of grade, gender, self-efficacy, learning style preferences, academic achievement, and academic aptitude. The discriminant function equation proved to be significant ($X^2=121.69$, $p<.00001$). All eight predictor variables proved to be significant and accounted for 22 percent of the variance between groups.

As a group, the students who received the Type II training were 64 per cent more likely to initiate a Type III investigation than the students who did not receive the training. Participation in group was about three times more important than grade, and more than three times as important as gender, achievement and prior involvement in creative projects in predicting which students would initiate Type III investigations. Learning style preferences for independent study and projects were relatively unimportant and pre self-efficacy scores were the second most powerful predictors of student initiation of Type III projects. The success of the experimental lessons that were developed for this study (Burns, 1987) suggests that teachers in programs that stress real world problem solving might consider spending more class time teaching students how to initiate and plan such projects. Burns concluded that teaching these skills prior to the initiation of the projects, would increase the number of students who undertake these investigations during the academic year.

Newman (1991) investigated the integration of a set of Talents Unlimited (Schlichter, 1986) training lessons (in creativity, planning, decision making, forecasting, and communicating) with teacher guidance in how to plan, manage, and complete a Type III investigation in order to examine the effects of these lessons on the quality of products and number of students who chose not to complete products. Talents Unlimited is often used as a Type II training component in SEM programs. Subjects included 147 Talent Pool students in grades three through six, from three school systems which implement the SEM and the Talents Unlimited model. Students in the treatment group received training in applying the Talents Unlimited model to steps of investigating a real problem. Students in the comparison group continued to follow guidelines described in the *Schoolwide Enrichment Model* (Renzulli & Reis, 1985) as they pursued their investigations. Data collection included tallies of the number of Type III investigations initiated, the number actually completed, and the number of students who did not complete Type III studies. Student products were evaluated by two independent raters using the *Student Product Assessment Form* (Reis, 1981). In addition, logs and conferences were used to provide an internal check on the consistency of procedures, as well as to determine student and teacher perceptions, attitudes, and reactions to the treatment lessons. When examined in relation to the comparison group, the treatment group had significantly fewer students who did not complete products, as measured by Chi-square analysis $X^2=$ (1, $N=160$) $=20.198$; $p<7.05$. Results of analysis of variance procedures also showed a significant difference in the quality of products completed by students in the treatment group. Finally, qualitative

analysis supported the statistical analyses and indicated favorable reactions from students and teachers toward the treatment.

Investigations of Student Creative Productive Behaviors

Delcourt (1988) and Starko (1986) investigated student creative productivity. Delcourt (1988) investigated characteristics related to creative/product behavior in adolescents who consistently engaged in first-hand research of self-selected topics. The topics were related to activities both within or outside of school. Selection of students for this study was based upon the quantity and quality of their projects. Therefore, giftedness was viewed as being manifested in performances. In contrast to a static perspective of the gifted individual, this conception of giftedness focused upon the dynamic nature of gifted behavior (Renzulli, 1986). The sample consisted of 18 students in grades 9 through 12 from four sites in the Northeast. All sites were located in typical high schools, as opposed to special schools for the gifted and talented. These schools conducted programs for the gifted and talented, focusing upon the development of creative/productive behavior in students. Programming included advanced placement courses, honors classes, special seminars, and mentorships.

A qualitative analysis of student interviews, questionnaires, and documents was conducted. To provide checks for both reliability and validity of collected data (Smith, 1975), triangulation was sought from three sources: the school, the student, and the parents. A microcomputer program, The Ethnograph (Seidel, Kjolseth, & Seymour, 1988), was employed for Sorting and retrieving coded text data. Responses to the following question were analyzed: "Having developed several products, how do you think your ability to work on these projects has changed over time?" These responses were separated into the following groups: (a) changes related to improvements in products, changes related to the skills necessary for product completion (e.g., writing, research methodology); (b) changes in personal characteristics (e.g., patience, self-satisfaction); and (c) changes related to career choices. Results concerning the family, the school, and the individual revealed the following: (a) targeted students do exhibit characteristics similar to those of creative/productive adults; (b) these students can be producers of information as well as consumers; and (c) the learning processes of these students merit closer attention if their abilities are to be better understood by themselves, their parents, and their teachers.

Starko (1986) also examined the effects of the Schoolwide Enrichment Model on student creative productivity. This research compared students who participated in SEM programs for at least four years with students who qualified for such programs but received no services. Questionnaires were used to determine the number of creative products produced by both groups, both within school programs and in dependent activities outside of school, as well as to gather information about attitudes and skills associated with creative productivity. Hierarchical multiple regression, as well as qualitative analysis of open ended questionnaire items, was used for data analysis. Results indicated that students who became involved in independent study projects in the SEM more often initiated their own creative products both *in and outside of school* than did students in the comparison group. A total of 58 students in the program when compared to 45 students in the comparison group participated in the study. The group in the enrichment program reported over twice as many creative projects per student (3.37) as the comparison group (1.4). The group that participated in the enrichment program also reported doing over twice as many creative products outside of school on their own time (1.03) than the comparison group (.50).

Additionally, students who had participated in the enrichment program showed greater diversity in projects and more sophistication in both the creative products attempted and in their description of goals. One student was not just "painting" but "painting and working on a catalogue of my paintings," others did not just read about animals but "observed the habits of wild animals and recorded my observations." Other examples from the enrichment group include students who composed music, wrote novels in various genre (romance, mystery, etc.), created a launching system for model rockets, designed and built model houses and furniture.

Research on SEM Relating to Personal and Social Development

Several studies have investigated aspects of personal and social development of students involved in SEM programs. Delisle (1981) examined the self-concept and locus of control of talent pool students. Olenchak (1991) examined the effects of SEM on attitudes toward learning and self-concept. Skaught (1987) investigated the social acceptability of talent pool membership. Heal (1989) compared perceptions about being labeled gifted across four types of elementary programs, including and SEM program.

Self-Concept Research

Delisle (1981) examined academic self-concept and locus of control in his study of the implementation of the model. In a manner similar to Reis (1981), Delisle investigated differences between a group of students who were traditionally identified by achievement or IQ (the top five percent) and an expanded talent pool (the next 15 – 25% as identified locally). No measurable difference was found in the product completion rate by students in the traditional group when compared to students in the expanded talent pool, Delisle found the following significant correlations regarding self-concept and locus of control in students in Grades 4 – 6, confirming the relationship of nonintellectual factors in the development of creative productivity.

1. Children with high academic self-concepts tended to “revolve in” to the resource room ($r=.210$, $p<.001$).
2. Children with high academic self-concepts tended to complete their initiated projects ($r=.201$, $p<.001$).
3. Children who internalized their academic successes tended to “revolve in” to the resource room ($r=.123$, $p<.001$).
4. Children with high academic self-concepts tended to internalize their academic successes ($r=.346$, $p<.001$).
5. Children who internalized their academic successes tended to internalize their academic failures ($r=.193$, $p<.001$) (pp. 38; 40).

Olenchak (1991) examined the effects of SEM on attitudes toward learning and on self-concept among 108 elementary students with concomitant learning disabilities. The effects of SEM on the creative productivity of these youngsters were also studied. Using a hierarchical regression model that controlled for pretreatment scores and the intervening variables suggested from the previous studies, gifted/LD student attitudes toward learning were significantly improved ($p<.01$). With regard to self-concept scores, the study showed statistically significant gains among all of the students; differences between pretest and posttest scores were significant for dependent t-tests ($p<.001$), and the effect size was .339. When self-concept results were analyzed via ANCOVA as 6 control for the pretest, no significant differences in gain between gender and across grade levels were revealed ($p=.33$). Analyses of student productivity paralleled those from the first study: namely, that students completed a high percentage of the Type III investigations they initiated and that their completed projects were of high quality (Olenchak, 1991). Taken together, the results of each of these studies support the use of SEM as a plausible means for meeting the educational needs of a wide variety of high-ability students.

Research Related to Social Acceptability

One of the goals of the SEM is to reduce the “condition of separateness” that often exists between gifted and regular school programs. SEM attempts to minimize the negative attitudes expressed toward high-ability students receiving special services through a broader definition of giftedness and services to both identified talent pool students and non-talent pool students. Skaught (1987) examined the nature of the social acceptability of talent pool students at the elementary level in a school using the Schoolwide Enrichment Model. Previous research has indicated that identified gifted students perceive themselves as ostracized by their classmates (Torrance, 1965; Webb, Meckstroth, & Tolan, 1982), and some gifted children report encountering hostility and ridicule from

fellow students who mock the advanced abilities of brighter children (Delisle, 1984; Feldhusen, 1985).

In Skaught's study, sociometric measures were analyzed to determine the social acceptability of talent pool students before and after receiving special services for high-ability students. Pretest and posttest scores on a peer relationship scale of a self-concept test were used to assess the talent pool students' perceptions of peer acceptance. Results indicated that students identified as above average in a SEM program were positively accepted by their peers. Skaught (1987) also found that a "condition of separateness" did not exist in schools where the SEM had been implemented.

Research Related to Perceptions About Labeling

Using a comparative case study analysis, Heal (1989) described and analyzed patterns of gifted students' perceptions toward being labeled gifted within and across four elementary program models in southern New England. The administrative conditions for these models included the SEM, a pullout program serving the top 5% of the student population, full-time classes for the gifted, and an independent school for gifted students.

Previous studies have examined the concept of labeling from various perspectives; however, only a few studies have investigated labeling from the perspective of the labeled youths. Likewise, only a small number of researchers have utilized the labeling perspective of social deviance theory in order to examine gifted and talented populations. No previous research could be located that explored the labeling of giftedness under different administrative conditions. The data in this qualitative research study were collected from 149 students in grades 4 through 6 using open-ended questionnaires, in-depth interviews, and writing samples. Triangulation and cross-validation of data assisted in revealing the emerging patterns, as well as controlling for bias. The results revealed that identification procedures, the program structure, and the resulting interpersonal reactions contributed to gifted students' perceptions of being labeled. While placement was not a problem for the youngsters in the SEM program, becoming a program member was problematic for almost all of the students from the other programs. The youngsters reacted negatively to the gifted label, their loss of friends, heightened teacher expectations, and the rigorous workload. The females reported a greater number of negative reactions than did the males. As the program models became more segregated and as the use of the gifted label increased, the reactions toward the label intensified; SEM was associated with reduced negative effects of labeling.

Research Related to Underserved Populations

Emerick (1988) and Baum, Renzulli, and Hébert (in preparation) have investigated underachievement of high potential students. Taylor (1992) studied students at a vocational-technical school, a population rarely considered in previous research about high-ability students. Baum (1985, 1988) examined highly able students with learning disabilities, identifying both characteristics and programmatic needs.

Underachievement

Emerick's 1988 study of gifted students' perceptions of factors relating to their reversal of underachievement did not purposefully investigate the Schoolwide Enrichment Model. Nevertheless, this research supports the use of various components within the SEM for use with underachieving students. Emerick examined the perceptions of 10 subjects, ages 14-20, who had improved their below average academic performance without participating in a planned intervention. Emerick used a qualitative, methodological approach; she collected data through interviews and written questions and used inductive analysis to reveal themes and patterns. Results indicated that gifted underachievers who had reversed the underachievement pattern perceived six factors as contributing to the reversal process: the gifted underachiever, the parent, the teacher, the nature and content of the class, the personal goals of the underachiever, and the out-of-school interests of the student. Specific personal characteristics were attributed to gifted underachievers who had reversed the underachievement pattern. These characteristics included a high degree of individuality and independence, a desire to be productive, and a need for personal interaction while involved in

learning experiences. The components of the Triad Model that Emerick believes have a possible effect on the reasons for the reversal of underachievement include: the use of curriculum compacting, exposure to Type I experiences, opportunities to be involved in Type III studies and an appropriate assessment of learning styles to provide a match between teachers who understand the unique learning modes and students who may be underachieving (Emerick, personal communication, January 12, 1992).

Based on the findings of Emerick and others, Baum, Renzulli, and Hébert (in preparation) investigated the use of the SEM as a systematic intervention for reversing underachievement. Using a qualitative case study approach, 12 teachers who had received training in the model selected 17 students identified as gifted who were underachieving in their academic classroom settings. The 17 students ranged in age from 8-13 and included five girls and twelve boys. All students were guided through a Type III study by their referring teacher. Various student data were collected including: ability and achievement tests, grades, classroom records, work samples and anecdotal information. Several findings emerged regarding the use of Type III as an intervention to reverse underachievement. First, a variety of factors contributed to the underachievement of gifted students including: emotional issues (such as dysfunctional families); social and behavioral issues (such as the influence of an inappropriate peer group); the lack of an appropriate curriculum many (students not motivated by the regular curriculum); and either a suspected learning disability or poor self-regulation. The most compelling finding of this research study was the positive gains made by underachieving students through their involvement in the Type III intervention. Almost all students continued to make progress during the course of the year, and in the year following the intervention, 84% of the subjects were no longer underachieving.

Gifted Students at a Vocational/Technical High School

Taylor (1992) examined the effects of the SEM on career development of gifted students at a vocational/technical high school. Career development has been defined as the continuous process of making career decisions based on the individual's experiences and interactions (Houston, 1990). Secondary gifted programs provide services to students at a time when their main focus is determining individual identity, and they are involved in recognizing and exercising their particular interests, competencies, and values. It seems probable that services provided to students during this time period will have an impact on their career development. Taylor found that involvement in Type III studies substantially increased the post-secondary education plans of gifted students in a vocational/technical school. Specifically, students changed their college plans from attending 2.6 years to attending 4.0 years of post-secondary education after they completed a Type III study.

The significance of this research is especially important when closely examining the ramifications in career development of special populations. This study indicates that involvement in the creative productive process enables students to reassess their vocational identity. The establishment of programs for academically able youth, which affect the career aspirations of students, is especially important in populations where student aspirations do not match their potential.

High-ability Students with Learning Disabilities

In another study dealing with underserved gifted students, Baum (1985) investigated the characteristics which distinguish High-ability/LD students from learning disabled students with average cognitive ability and high-ability students. High-ability or learning disabled students ($N=112$) in grades four through six participated in the study. A variety of instruments were used to assess and compare cognitive and motivational patterns in three groups: High-ability, High-ability/LD, and LD/Average. Discriminant function analyses indicated that the three groups are distinguishable. As might be expected, the greatest group difference existed between high-ability nondisabled students and both learning disabled populations. A second discriminant function provided information about differences between the two learning disabled populations. Baum's analysis revealed important differences among the three groups, although the High-ability/LD vs LD/Average distinction was more subtle. High-ability students were more creative and enjoyed a higher sense of academic self-efficacy than those in either learning disabled group. High-ability/LD students displayed more

interest in creative activities and were viewed as more creative by their teachers than students of the LD/Average group. High-ability/LD students also caused the most classroom disturbance and perceived themselves as less efficacious in academic tasks. Based on these findings, Baum recommended the SEM as one vehicle to meet the unique needs of gifted students with learning disabilities because of the emphasis on strengths, interests, and learning styles.

Baum (1988) later used the SEM with this population in a pilot program. Seven bright learning disabled youngsters in grades 4 – 5 met for 2 1/2 hours a week over a nine-month period to develop their strengths and interests through challenging enrichment activities. Six of the seven students showed gains in self-esteem, learning behavior, and creative productivity. Type I and Type II experiences were provided to spark the children's interests in a future investigation. To expose the students to the process of creative production, a student-initiated group project was undertaken. The students wrote and illustrated a unique children's book. Upon completion of the book, the students were encouraged to initiate individual investigations. Conferences were held with each student to assist in identifying a real problem, defining a purpose and an audience for the study, and selecting a final product. A step-by-step management plan and a contract with clear expectations were developed for each student to facilitate product completion.

Short-term findings included: the completion of high-quality products by six of the seven students; improvement in behavior, specifically the ability to self-regulate time on task for as much as 2 1/2 hours; improvement in self-esteem; and the development of specific instructional strategies to enhance the potential of the gifted learning disabled student.

Research on SEM Relating to Self-Efficacy

Bandura (1977a) described self-efficacy as a cognitive mediator of behavior and defined it as an individual's belief in his or her ability to successfully perform in a given situation. Bandura (1977b, 1982) found that estimations of the ability to carry out a particular behavior were correlated with subsequent performance of that behavior and that certain interventions increased both self-efficacy estimations and subsequent performance of target behaviors. Efficacy beliefs influence whether the behavior will be initiated, the amount of effort that will be expended, and the degree of perseverance in the face of difficulty. Accordingly, some researchers have hypothesized that the successful completion of a Type III study, should raise students' self-efficacy regarding future efforts. Schack (1986) investigated the effect of participation in a treatment designed to increase self-efficacy on both efficacy and involvement in Type III projects (independent or small group investigations). Schack (1986) defined self-efficacy as "an individual's level of confidence doing a particular behavior" (p. 19). Subjects were 294 students in grades four through eight who were participants in gifted programs based on the Enrichment Triad Model in eight schools. Hierarchical multiple regression analysis was used to investigate whether participation in a research methodology mini-course explained initiation of independent investigations beyond what was accounted for by grade, sex, years in the gifted program, and previous Type IIIs completed. Two causal models were tested, using stepwise multiple regression and path analysis. The first model postulated the influence of grade, sex, years in the gifted program, previous Type IIIs, pre- and post-treatment self-efficacy, and initiation of a Type III on final efficacy scores. The second examined the role of the first six variables and participation in the treatment on subsequent initiation of Type IIIs by students who had not done so prior to the start of the treatment (Schack, Starko & Burns, 1991). Self-efficacy was a significant predictor of initiation of Type IIIs, and self-efficacy at the end of the treatment was higher for students who participated in Type IIIs. The effect of treatment on self-efficacy or subsequent initiation of Type IIIs was not significant when considered with the other variables in the causal model. Schack's research supported the role of self-efficacy in creative productivity among above average ability children in gifted programs designed to encourage such behavior, though the influence of an intervention to increase efficacy or the target behavior was not demonstrated.

Additional studies (Starko, 1986; Stednitz, 1985) were conducted involving the self-efficacy of students in a gifted program using the Enrichment Triad Model. Stednitz defined school-related self-

efficacy as “children’s estimation of their ability to perform a certain school-related behavior” (1985, p. 5). Stednitz found that “very young children are able to estimate perceived ability on specific tasks.” Yet her findings indicated that participation in an eight week series of Type I Enrichment Activities failed to show any changes in self-efficacy. Additional qualitative analysis conducted by Stednitz (1985) suggested that the series of enrichment activities that did not result in changes in self-efficacy did have other positive effects. An interest questionnaire was administered to both treatment and control group students when asked what they would like to collect and what they would like to learn about, enrichment topics were mentioned 28 times by children in the treatment group and 10 times by children in the control group (Stednitz, p. 90). These and other qualitative data gathered by Stednitz suggest “that the activities offered during the treatment phase of the study increased the interest and curiosity level of children in the treatment group as compared to children in the control group. It remains to be shown how to sustain and make such interests grow” (Stednitz, p. 92).

Starko examined the relationship between efficacy and creative productivity by examining levels of participation in a Triad/RDIM program, creative productivity inside and outside of school, and self-efficacy with regard to creative productivity. This study compared students who had participated in Triad/RDIM programs with comparable students who had been identified for a gifted program but had not yet received services. Analysis indicated that the number of creative products produced in school was a highly significant predictor of self-efficacy ($p < .001$), explaining 16.5% of its variance. Group alone was not a significant predictor of self-efficacy, suggesting that being in the Triad/RDIM gifted program was not sufficient to increase self-efficacy as a creative producer; participation in a Type III project was necessary.

SEM as a Curricular Framework

Karafelis (1986) investigated the use of the SEM as a curriculum framework in language arts. This comparative study involved 80 fifth and sixth grade students and the use of two different language arts curriculum based on pre-specified learning objectives. The experimental group was provided a drama curriculum based on Triad by classroom teachers who had received training in the model. The curriculum included poetry, readers’ theater, mime, improvisation, and playwriting. The treatment lasted for one hour each day for a six month period. Four intact classes were used and gifted students were compared to average and low ability students among classes. The control group continued the use of traditional texts and workbooks, as had been the standard in the district. No significant differences were found between treatment and control groups with respect to reading comprehension scores, as measured by the Stanford Diagnostic Reading Test, a valid and reliable measure of both literal and inferential reading comprehension. According to Karafelis, the drama program, entitled Tri-Art Drama, was as effective a method of teaching reading comprehension as the traditional basal reading program used by the control group (Karafelis, 1986, p. 99). Karafelis also found that the highest group on cognitive assessment measures achieved higher scores than lower cognitive ability groups. “These results indicated that the higher a subject’s cognitive ability, the greater his/her achievement in reading comprehension will be” (p. 116). Although the original Enrichment Triad Model (Renzulli, 1977) was not created to be a curriculum development model, it does provide an organizational framework that enables teachers and researchers to substitute the three types of enrichment experiences for more traditional forms of instruction. In the drama curriculum based on Triad created in this study, enrichment experiences based on drama skills were substituted for a traditional basal reading curriculum, and students receiving the experimental treatment did equally well on achievement tests as the control group.

Research Relating to Learning Styles and Curriculum Compacting

Smith (1976) and Stewart (1979) investigated the use of learning styles. Imbeau (1991) and Reis, et al. (1992) studied on the effects of curriculum compacting.

Learning Styles

The instrument suggested for use in the analysis of learning styles is the *Learning Styles Inventory*

(LSI) (Renzulli & Smith, 1978b). The LSI is a research-based instrument designed to guide teachers in planning learning experiences that take into account the learning style preferences of students within their classrooms. The instrument consists of 65 items that provide information about student attitude toward lecture, projects, drill and recitation, peer teaching, discussion, teaching games, independent study, simulation, and programmed instruction.

The initial study of the effectiveness of the LSI was carried out by Smith (1976). In addition to reporting validity and reliability data, this study examined the relationship of learning style to student achievement, motivation and interest in subject matter, as well as the relationship between traditional measures of school success and specific achievement, motivation, and interest. Overall, the results of this study confirmed the fact that matching learning style significantly enhances educational outcomes. Students who were taught in their preferred method achieved better, were more interested in the subject matter, liked the way the subject was taught, and wanted to learn other school subjects in the same way. Motivation was not significantly different for students who were matched to instruction meeting their preferred learning modes when compared to unmatched students. It should be noted that the learning style variable also explained a significant portion of the variation in achievement and interest that was unaccounted for by such traditional predictors of school success as IQ and prior achievement.

Stewart (1979) investigated the difference in preferred learning style between gifted students and students in the general population. Her results indicated that gifted students differ significantly from students in the general population, with lecture, independent study, discussion, and projects contributing most to the differences between the two groups. Lecture showed the greatest variation, with students in the general population showing a stronger preference for this style of instruction than gifted students. Stewart also found that grade level, sex, locus of control, and favorite subject significantly affected learning style references. Based on these findings, it was concluded that gifted students tend to prefer instructional methods that emphasize independence while students in the general population prefer instructional methods with more structure. Stewart concluded that while many factors influence learning style preferences, the assessment of learning style appears necessary for planning appropriate educational programs for various subgroups of students.

Curriculum Compacting

Imbeau (1991) examined the role of teachers' attitudes toward curriculum compacting with regard to the implementation of the procedure. Four groups of teachers (three treatment and one control) representing grades 1 through 12 from a large urban district comprised the sample ($N=166$) for her study. The treatments consisted of a full day training session conducted by the researcher with three different follow-up strategies. An instrument developed by Imbeau, the Curricular Modification Survey, was used to assess teachers' attitudes toward curricular modifications. The regression analyses indicated that group membership was a significant predictor of posttest teachers' attitudes. Follow-up t-tests using adjusted means revealed that for the group of teachers that had been instructed to consult with another teacher (peer coaching), significant differences were found ($p<.05$) when compared to the control group of teachers who did not receive training or follow-up services.

A study that was recently completed at the University of Connecticut's National Research Center on the Gifted and Talented (NRC/GT) (Reis et al., 1992) examined strategies that teachers use to compact curriculum so that it accommodates the specific strengths of high-ability students. The study further examined the kinds of replacement activities that can be used to provide more appropriate levels of curricular challenge. A sample of 27 school districts and approximately 465 second- through sixth-grade classroom teachers throughout the country from NRC/GT collaborative school districts were selected for this study. Three treatment groups which received increasing levels of staff development were used to examine the most efficient but effective method for training teachers to modify curriculum. Teachers from a fourth set of classrooms served as a control group and, therefore, received no training.

Three important findings emerged from the study. The first might best be described as the more-for-less phenomenon as 40 to 50% of traditional classroom material was compacted for targeted students in one or more content areas. When teachers eliminated as much as 50% of regular curricular activities and materials for targeted students, no differences were observed in post test achievement scores between treatment and control groups in reading, math computation, social studies, and spelling. In science, the students in Treatment Group 1 whose curriculum had been eliminated by 40-50% scored significantly higher in the Iowa Test Basic Skills (ITBS) than their peers in the control group. Students whose curriculum was compacted in mathematics by 40 to 50% scored higher on the post ITBS on the math concepts than their control group counterparts whose curriculum was not compacted. Second, 95% of the teachers in the study were able to identify high-ability students in their classrooms and to document individual student strengths indicates that teachers are able to identify high-ability students in their classrooms. Finally, although the majority of teachers provided various types of curricular activities to students whose curriculum was compacted, replacement strategies often did not reflect the types of advanced content that would be appropriate for high-ability students. This finding indicates that additional staff development is necessary, especially as it relates to appropriately challenging replacement strategies. This finding was confirmed through anecdotal records, which indicated that teachers would like more access to consultant assistance from enrichment or gifted education specialists, and more training and assistance in locating and using appropriate enrichment materials.

Longitudinal Research on SEM

As reported earlier, Delcourt (1988) identified 18 secondary school students who exhibited creative/productive behavior by consistently engaging in first-hand investigations of self-selected topics (Type III studies) both in and out of school. After a three-year interval in a longitudinal study, subjects were sent a questionnaire focusing on their interests, educational and professional experiences, career plans, and projects (Delcourt, in press). Results indicated that students maintained similar or identical career goals from their plans in high school and major fields of study in colleges. College students were satisfied completing projects related to their courses or their professions since these assignments coincided with their interests and goals. This apparently made their investigations easier to complete. By contrast, three years ago they reported little or no relation between personally initiated and assigned high school projects. Some of these young adults were not particularly concerned with high levels of attainment in their careers, but rather with good relationships with friends and family. Overall, the young adults who participated in the follow-up study reported being satisfied with their academic and professional choices. Perceptions of their professional success will be sought in a continuation of this longitudinal study. Based upon each student's level of involvement with his or her investigations and the quality of their projects, Delcourt's study supports the concept that adolescents and young adults can be producers of information.

In an examination of students who participated in a Triad program for almost a decade, Hébert (1993) found several benefits of program involvement. Nine senior high school students from the program underwent extensive interviews concerning their educational experiences 10 years after their involvement in the program. The students selected for the study were chosen because of the creative productivity (Type IIIs) they exhibited during their elementary TAG Program experience. The interviews with the students concerning their Type III experiences were transcribed and analyzed for themes. Five major findings from the study provide insightful information for educators responsible for implementing programs for high-ability students. The findings were: (a) Type III interests of students affect post-secondary plans, (b) creative outlets are needed in high school, (c) as decrease in creative Type III productivity occurs during the junior high experience, (d) the Type III process serves as important training for later productivity and (5) non-intellectual characteristics with students remain consistent.

Conclusion

During the last decade, a great deal of research has been conducted on The Schoolwide Enrichment

Triad Model (SEM) in a variety of educational settings and in schools that serve diverse ethnic and socioeconomic populations. In addition to these formal research studies, evaluation reports have been prepared by many of the hundreds of school districts across the world which have adopted the model. This review incorporates both kinds of evidence.

The results of this synthesis of research on the SEM must be interpreted with caution. The design of most of the studies was nonexperimental and descriptive and, as such, does not allow causal conclusions to be drawn between the model and the various outcomes described in this article. One example may highlight the difficulties involved in this type of field-based educational research. Starko, (1986) examined the effects of the SEM on creative productivity and self-efficacy by comparing two groups of subjects who were either involved for 4 years in an SEM program or who were not involved in any enrichment program. The data collected supported the relationship between students' Type III projects and creative productivity both within and outside the program. However, the quasi-experimental nature of the study enables alternative explanations to be considered for this finding, including differences in group ability or achievement, varying curricula and/or instructional strategies, or any of a number of other social or cultural variables relative to the two districts which participated in the research.

Given these limitations, the research reviewed in this article suggests that the use of this programming model:

1. favorably influences teachers' instructional practices
2. improves teachers' attitudes toward the education of gifted students and of elementary students' attitudes toward learning and self-concept
3. is associated with positive changes in many aspects of schooling including instructional activities and student projects
4. encourages creativity and task commitment in targeted students
5. encourages more diverse and sophisticated student products
6. provides appropriate intervention for special populations of gifted students, including LID gifted and those who are identified as underachieving
7. assists many students in traditional programs for the gifted as well as high-ability students in vocational/ technical schools to plan appropriate career choices
8. can provide an appropriate curricular framework for all students, especially when the implementation of SEM includes the use of learning styles, interests, and curriculum compacting

Research on the SEM also suggests that the model may improve aspects of high-ability students' school experience, including classroom climate, instructional processes, students' self-concept, attitudes toward learning, and postsecondary plans, as well as administrative support and staff morale.

Future Directions for Theory-Based Research on Enrichment Program Models

The use of educational enrichment represents a complex approach to programming for students of high potential. Enrichment programs are often characterized by a commitment to the development of higher powers of mind, advanced levels of product development, and learning outcomes that represent a synthesis of cognitive, affective, and motivational behaviors. The complexity of the goals and outcomes of enrichment models presents a somewhat unique problem for educational researchers because these outcomes cannot be measured as easily and precisely as those objectives that deal with the acquisition of specific skills. As we move up the scale of learning behaviors, from the simple acquisition of knowledge to the development of complex thinking processes as reflected in creative student products, it becomes increasingly difficult to find evaluation instruments that meet the scientific and practical requirements necessary for high quality

research. While virtually hundreds of valid and reliable instruments are available to measure basic skills in traditional areas of school achievement, instruments for evaluating higher level processes and products are not readily available. Learning outcomes in enrichment programs often relate to the development of interests, the acquisition of independence and self-directed learning, and the joy of learning that is developed through self-selected studies.

A second issue related to research on enrichment programs is that individualized objectives are often developed for each student involved in the program. The use of standardized testing may be appropriate for those aspects of a program in which standard group instructional practices are followed. However, when program objectives and related services vary because of a commitment to accommodate individual interests, abilities, and learning styles. Many of the “rules” of standard research design and the use of normative referenced tests do not readily apply. Future research on enrichment models should take into consideration their unique and complex characteristics. If differentiated objectives require differentiated educational services, then it follows that differentiated research practices will be necessary to examine various aspects of program effectiveness.

Measurement and formal testing often play a major role in research studies, but certain cautions are necessary when we consider the use of standardized tests in carrying out research studies on programs that serve gifted and talented students. In addition to measurement problems implicit in the discussion of higher level objectives discussed above, problems often arise when we attempt to use norm referenced tests that were developed for general populations. Conventional standardized tests are based on the normal distribution curve, and for this reason, the equality of units of measurement is open to question. The main issue in using age, grade, or percentile norms is that we cannot assume that a year’s growth or growth in a given number of percentile points is a uniform unit. Thus, for example, if the performance of an average student increases from the fortieth to the fiftieth percentile over the course of a school year, we cannot assume that this is a greater gain than that made by a student whose score increased from the ninetieth to the ninety-fifth percentile. The higher scoring student initially scored at the upper end of the normal curve continuum where it is much more difficult to show incremental growth that is reflected in percentile score points. The same is true for age and grade scores. Generally, there is a slowing down of gains at the upper level of most performance tests that were normed on general populations. For this reason, research studies using standardized tests should avoid making comparisons between gifted students and other populations. This can be done by developing separate sets of norms for each distinct population whose growth is being evaluated, provided of course, that the test has a broad enough range to allow students to show maximum growth. If a test does not have enough “top” in it, highly able students may score at the upper limits, but we will be unable to determine their true growth because of the low ceiling of the test. Since many standardized tests are designed to provide achievement information for the vast middle ranges of ability, their content in interpretive data may not be valid for children who deviate markedly upward from the mean.

The use of conventional tests with gifted and talented students also presents some problems in the statistical treatment of research data. As was pointed out earlier, test reliability is a function of group diversity—the more heterogeneous the group the higher the reliability. Since gifted groups frequently are, by definition, relatively homogeneous groups, and therefore frequently show a narrower range of test scores than the population in general we should be extremely cautious when viewing the reported reliabilities of standardized test. Unfortunately, most test publishers do not report reliabilities for sub-populations within their standardized sample, and therefore it may be necessary to conduct a “local” reliability study whenever conventional tests are used with special populations.

One of the major statistical problems encountered when working with the test scores of high-ability students is the well-known “regression toward the mean effect.” Although this is a complicated statistical phenomena, simply stated it means that predicted scores tend to “move in” toward the mean of the distribution. Thus, if we are using a pretest and a post-test designed to evaluate the effects of a program for the gifted, and if the students’ scores on the pretest are initially high, it is quite likely that their post-test scores will actually decrease due to the regression effect. Researchers

dealing with high-end populations should, therefore, exercise a great deal of caution when considering pre/post designs and other statistical designs that do not take into account the lack of normality in the distribution of gifted students' tests scores. When pretest and post-test scores are used, it may be necessary to use above grade level tests and to explore the use of non-parametric statistics or multivariate methods of analysis.

Finally, because of the problems discussed above, researchers who are examining the impact of enrichment models need to consider a combination of qualitative and case study designs as well as traditional quantitative experimental designs. Recent developments in more sophisticated qualitative and case study approaches, and a greater receptivity of these designs on the part of the research community at large, have opened the door to a broad new range of research possibilities for studies that are attempting to examine complex human behaviors. We believe that the nature of enrichment programs offers researchers one of the most creative challenges for the development of an entire new technology for educational research and new opportunities to contribute to the methodology as well as the content of the field.

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