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The Munich Model of Giftedness Designed to Identify and Promote Gifted Students

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A decisive factor in the determination of effective gifted education is the fit between the individual cognitive and noncognitive (e.g., motivational and other personality) factors of the developmental and learning processes on the one hand and the environmental influences that are mainly from the social settings of family, school, and peers on the other hand. This chapter is based on multidimensional conceptions of giftedness and talent, such as the Munich Model of Giftedness (MMG), as well as on interaction models, such as the Aptitude–Treatment Interaction (ATI) by Cronbach and Snow (1977) and Corno and Snow (1986).

When considering the MMG as an example of a multifactorial conception of giftedness, along with the recently developed dynamic process approach to this model (Munich Dynamic Ability–Achievement Model of Giftedness [MDAAM]), the following questions arise: How should gifted individuals be identified and instructed? And how should their learning outcomes or excellent performance be assessed? These and other questions will be answered according to the MMG and the MDAAM, respectively.

GIFTEDNESS AND TALENT FROM A THEORETICAL POINT OF VIEW

Our knowledge regarding giftedness and talent is supplied by different sources of information and research paradigms. Approaches that are particularly relevant to conceptualizing giftedness or talent are the psychometric approach, the expert–novice paradigm, explanatory approaches from the field of cognitive science or cognitive psychology, and social psychology, as well as retrospective and prospective (longitudinal) studies. Giftedness models developed in the 1980s and 1990s are characterized, almost without exception, by multidimensional or typological ability constructs, for example, Renzulli (1978), Mönks (1985), Gardner (1983, 1993), Gagné (1985, 1993, 2000), Heller and Hany (1986), Heller (1989, 1991/1996), or

Sternberg (1985, 1997, 2000, 2003). For conceptions of giftedness from a metatheoretical perspective, please refer to Ziegler and Heller (2000).

The Psychometric Approach

The Munich longitudinal study of giftedness – one of the most enlarged European studies in the last two decades (Heller, 1991, 2001; Heller & Hany, 1986; Perleth & Heller, 1994) – is based on a psychometric classification approach with several types of giftedness or talent factors. This multidimensional model consists of seven relatively independent ability factor groups (predictors), and various performance domains (criterion variables), as well as personality (e.g., motivational) and social environmental factors that serve as moderators for the transition of individual potentials into excellent performances in various domains (see Figure 9.1).

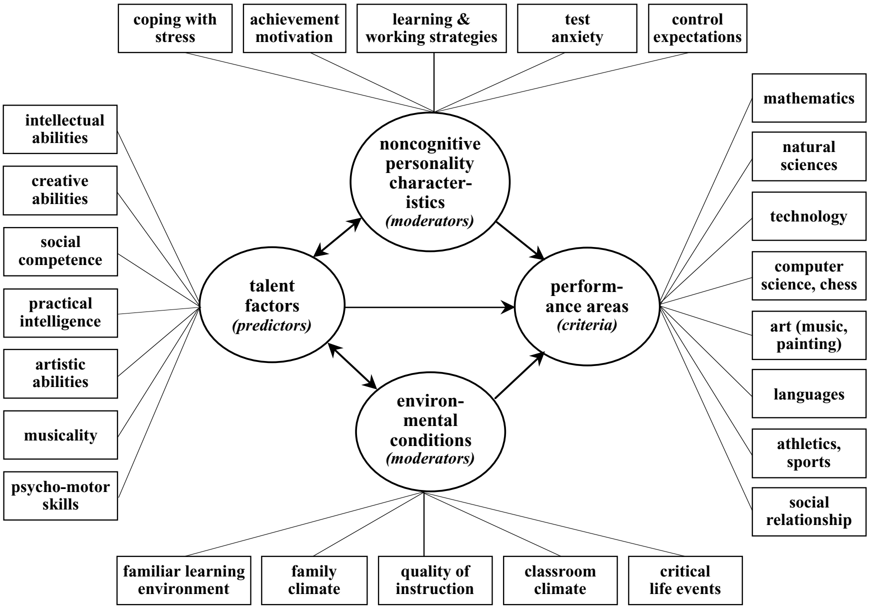
According to this nationally and internationally validated model (see Heller 1992, 2001; Perleth, Sierwald & Heller, 1993), giftedness is conceptualized as a multifactorized ability construct within a network of noncognitive (e.g., motivation, control expectations, self-concept) and social moderators, as well as performance-related variables. For diagnostic purposes, the differentiation between predictor, criterion, and moderator variables is of particular interest.

The Expert–Novice Paradigm

Explanatory concepts regarding giftedness are hardly less problematic. These concepts differ from one another in terms of the significance they attach to personality and/or sociocultural determinants within the structure of giftedness versus their manifestations in exceptional aptitude. Although the psychometric paradigm of research on individual ability potential (predictors) under specific motivational and social conditions (moderators) focuses *prospectively* on expected performance excellence (criteria) in scholastic, university, or career matters, expertise research tries another approach. In the expert–novice paradigm – consider, for example, the comparison of experts (e.g. physics teachers or professors) and beginners (e.g., students in an introductory physics course) – the central conditions surrounding knowledge and expertise acquisition are *respectively* recorded, providing an important supplemental contribution to the prospective approach of the psychometric research. It is only recently that theoretical and empirical attempts have been made to combine both research paradigms to optimize the amount of insight to be obtained from research (cf. Perleth, 2001; Schneider, 2000).

Synthetic Approaches

In recent years, *synthetic approaches* have been favored in the field of giftedness research. Thus, introducing findings from the expertise and



Legend:

Talent factors (predictors)

- intelligence (language, mathematical, technical abilities, etc.)
- creativity (language, mathematical, technical, artistic, etc.)
- social competence
- musicality
- artistic abilities
- psycho-motor skills
- practical intelligence

(Noncognitive) personality characteristics (moderators)

- achievement motivation
- hope for success vs. fear of failure
- control expectations
- thirst for knowledge
- ability to deal well with stress (coping with stress)
- self-concept (general, scholastic, of talent, etc.)

Environmental conditions (moderators)

- home environmental stimulation ("creative" environment)
- educational style
- parental educational level
- demands on performance made at home
- social reactions to success and failure
- number of siblings and sibling position
- family climate
- quality of instruction
- school climate
- critical life events
- differentiated learning and instruction

Performance areas (criteria variables)

- mathematics, computer science, etc.
- natural sciences
- technology, handicraft, trade, etc.
- languages
- music (musical-artistic area)
- social activities, leadership, etc.
- athletics/sports

FIGURE 9.1. The Munich Model of Giftedness (MMG) as an example of multi-dimensional, typological conceptions (according to Heller et al., 1992, 2001).

cognitive functioning approaches, as well as evidence from the research of connections between cognitive abilities and professional achievement, Perleth and Ziegler (1997; also see Ziegler & Perleth, 1997) extended the original Munich Giftedness Model from Figure 9.1 to the Munich Process Model depicted in Figure 9.2. The triangle symbolizes the formation of

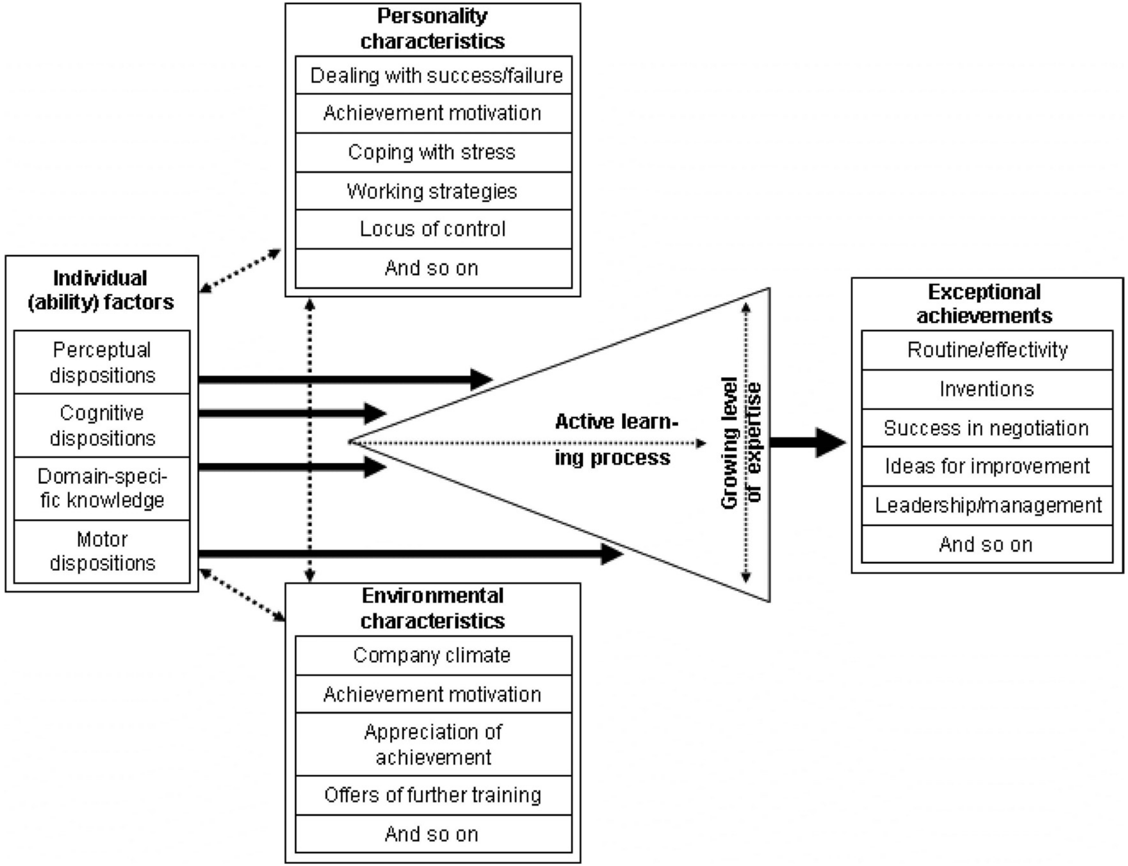


FIGURE 9.2. The Munich Process Model of Giftedness by Ziegler and Perleth (1997).

expert knowledge and routines in the course of a long and intense learning process (see *deliberate practice* by Ericsson, Krampe, & Tesch-Römer, 1993). Referring to Ackerman (1988) in the Ziegler and Perleth (1997) model, cognitive, perceptual, motor, and knowledge variables play the role of predictors or prerequisites for exceptional achievement instead of global ability factors as in the original MMG. According to this, it becomes clear that with an increasing degree of expertise, active learning processes influence expansions of knowledge and the acquisition of domain-specific competencies.

Conceptions referring to the expertise research imply that noncognitive personality characteristics, such as interests, task commitment (according to Renzulli), or achievement motivation are to be accorded increased significance regarding achievement development. It is questionable whether the time spent in active learning is exclusively responsible for achievement excellence in a specific domain, as implied by Ericsson's construct of *deliberate practice*. In any case, convincing proof has yet to be forthcoming from Ericsson and colleagues (e.g., Ericsson, 1996, 1998; Ericsson, Krampe, & Tesch-Römer, 1993) that adolescents or young adults are capable of reaching the same degree of expertise as the gifted in randomly chosen domains – independent of individual talent prerequisites. The formulation of threshold hypotheses (e.g., Schneider, 1993) is an attempt to rescue research findings accumulated with the expertise paradigm, without having to relinquish any significance of the cognitive learning and achievement potential for the development of expertise with a high standard (excellence) confirmed in psychometric giftedness research. This concern is actually more important than the insights gained from expertise research – not because of the realization of achievement excellence, but rather the information gained on how individual resources can be used for personal development.

Other synthetic approaches are Sternberg's conceptions of "giftedness as developing expertise" (Sternberg, 2000, p. 55) and his recent WICS model of giftedness (Sternberg, 2003), which is an acronym for Wisdom, Intelligence, Creativity, Synthesized. In the mentioned articles, Sternberg explains not only the relationship between giftedness and expertise, but he also argues "that giftedness is, ultimately, expertise in development" (p. 101). Intelligence, creativity, and wisdom are considered as the salient elements of giftedness.

The Munich Dynamic Ability–Achievement Model (MDAAM) – An Extended Version of MMG

Perleth (1997, 2000, 2001) made an attempt to bridge the gap between the research into giftedness and the more process-oriented field of cognitive and expertise research in the development of excellence. As he explains, an integrative model of giftedness has to fulfill the following requirements:

- conceptualize abilities and skills in a differentiated manner;
- take into account findings of genetic psychology and cognitive information processing research;
- consider the domain-specific character of achievements;
- make clear how cognitive abilities are transformed into achievements (e.g., by learning processes, amount of time spent learning, and the quality of experiences);
- consider acquisition of knowledge processes and the role of knowledge as prerequisites of achievement;
- include personality traits (e.g., interests, task commitment, stress resistance);
- pay attention to characteristics of variables such as family and school environment, as well as the role of peers and the professional community;
- be presented at an appropriate level of complexity so that it is convincing to teachers as well as parents of gifted children and youth (fulfilling one of Sternberg's [1990] criteria for a *good definition of giftedness*).

The model presented in Figure 9.3 attempts to integrate important perspectives of giftedness and expertise research and put them into a common and consistent frame. Even if Figure 9.3 might produce an opposite impression, Occam's razor was used for the conception of the model – *Entia non sunt multiplicanda sine necessitate*. The seeming complexity is due to the examples that were chosen for the illustration of the different groups of variables. Of course, no examples for the expertise domain were given because no selection seems adequate in the face of nearly unlimited possibilities.

Individual characteristics, such as aspects of attention and attention control, habituation, memory efficiency (speed of information processing) and working memory aspects, level of activation, and aspects of perception or motor skills can all be seen as innate dispositions or prerequisites of learning and achievement. Indeed, these characteristics represent the basic cognitive equipment of an individual (see Perleth, Schatz, & Mönks, 2000).

The model distinguishes between three or four stages of achievement or expertise development, which are related to the main phases of school and vocational training: preschool, high school, and university or vocational training. These stages can be roughly characterized by Plomin's classification (1994), which distinguished passive (preschool age), reactive (primary-school age) and active (adolescence and older) genotype–environment relations. It is to be expected that deviations from the "normal" development, especially with gifted individuals, are bound to occur. The fourth phase of professional activities is only indicated in

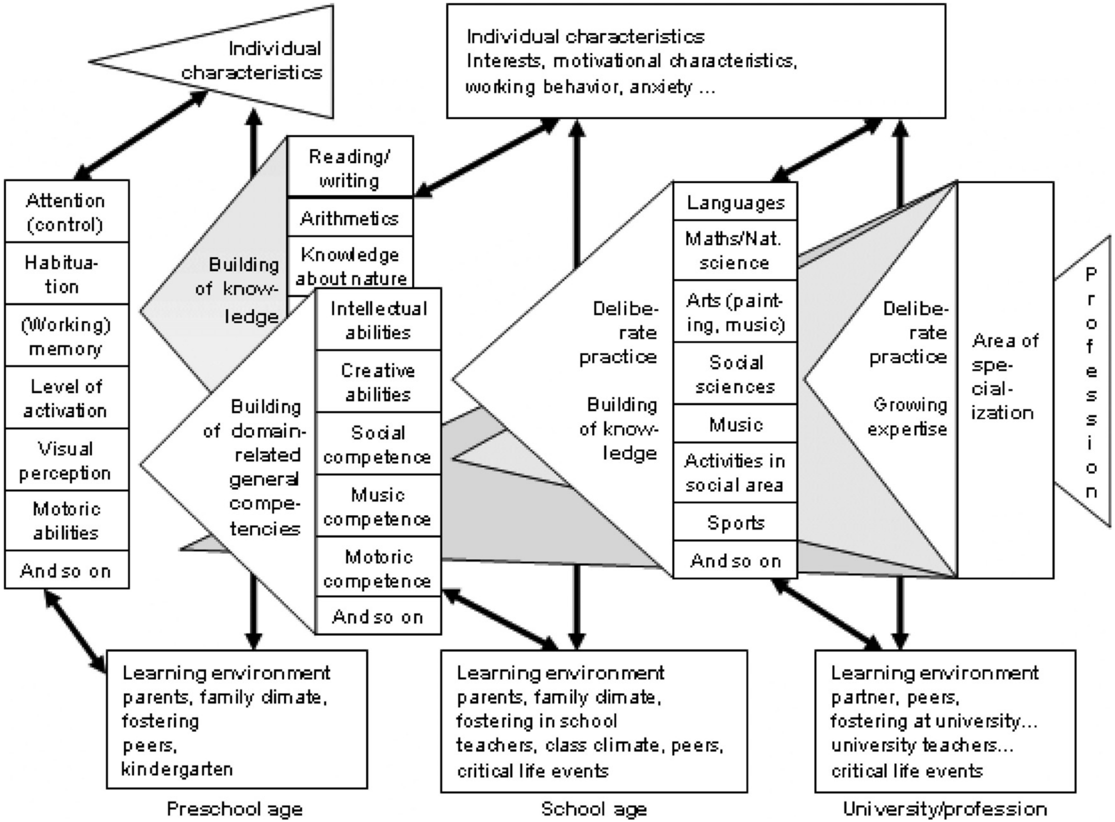


FIGURE 9.3. The Munich Dynamic Ability–Achievement Model according to Perleth (2001, p. 367).

the model and has to be completed by conception, as in the model by Ackerman (1988).

Certain learning processes belong to each of these stages. They serve the building up of competencies and are symbolized by the grey triangles. These triangles open to the right, indicating growth in abilities, knowledge, or competencies. The left corner of the triangles indicates when the respective learning process begins (the different tones of grey are just to make the figure clearer):

- During preschool years, the forming of general domain-related competencies is assumed. These are abilities or talents, such as intellectual or creative abilities, social competencies, and musical or motor abilities, which are depicted in the MMG as giftedness factors.
- The development of these competencies is contrasted by the accumulation of knowledge (nature, reading, writing, calculation).
- During school years, the formation of knowledge in different areas predominates (languages, natural and social sciences, arts, music, social behavior), and this knowledge has to be acquired in active, goal-specific learning processes (deliberate practice).
- The stage of university or vocational training serves the increasing specialization and development of expertise in a respective domain. Depending on the domain, this specialization can also start considerably earlier: Professional musicians or high-performance athletes often begin to occupy themselves with their domains as early as preschool or primary school (symbolized by the respective long triangles in Figure 9.3).

The MDAAM not only identifies ability factors and knowledge domains, as well as the respective learning processes, but it also highlights personality characteristics that are important for the development of achievement and expertise. As shown in the model, these traits develop during preschool and the first years of primary school (see Helmke, 1997), and they are conceptualized as being relatively stable during high school, university, or vocational training.

Finally, aspects of the learning environment are emphasized in the model for the development of achievement and expertise. Different factors for the three main stages of development are specified (see Figure 9.3 for more details). All in all, the influence of the family dominates in the first years, and then the characteristics of the school's learning environment (e.g., extra courses for the fostering of the gifted, school and class climate, extracurricular activities) gain more and more influence. At the same time, the importance of friends and like-minded individuals increases. Refer to Perleth (1997, 2001) for a more detailed description of the MDAAM.

IDENTIFYING AND PROGRAMMING

Methodological Problems of Talent Search and Identification of Gifted Individuals

The talent search for particular support programs is legitimized (a) through the right of every individual to receive optimal nurturance of talents and development; and (b) through the social demands on each individual, including the gifted, to make an appropriate contribution to the society (i.e., the gifted also have a duty to achieve special accomplishments that result from the needs of society).

Regarding the *function of talent searches*, it is necessary to be aware that the individual prerequisites and the demands of the new learning content in the advancement program for individual candidates "fit" together. Unfortunately, pure success criteria are often in the foreground of the selection process without consideration of moderators in the assessment (see following discussion). A comprehensive and differential evaluation of supportive measurements should, therefore, be an indispensable component of every talent search (cf. Feldhusen & Jarwan, 2000; Hany, 1993).

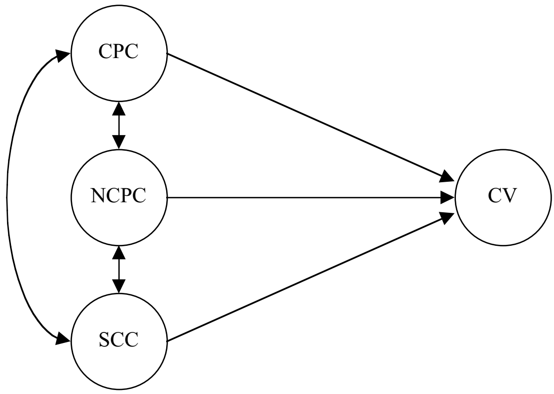
From a methodological standpoint, there must be differentiation between three groups of variables (see also Figure 9.1): (1) person-related talent indicators or *predictors*, (2) achievement *criteria* variables, and (3) person-related noncognitive traits of gifted individuals and sociocultural condition variables – both of these often serve as systematic *moderators* of the relationship (correlation) between predictors and criteria. Figure 9.4 illustrates the relationships based on the diagnosis-prognosis approach (according to Heller, 1989, p. 147).

The following skill concepts are psychometrically relevant as *cognitive personality characteristics* of gifted individuals:

- intelligence in the sense of differential abilities (e.g., verbal, quantitative, nonverbal, technical) or convergent thought processes (according to Guilford, 1959);
- creativity in the sense of divergent thought processes (according to Guilford, 1959) or divergent–convergent problem-solving styles (according to Facaoaru, 1985);
- self-concept, locus of control, and so on.

In contrast, the following process variables (in the sense of *metacomponents of cognitive control*) are appropriate for cognitive psychological approaches:

- problem sensitivity;
- planning and selection criterion for goal-oriented solution and action steps (during the solution of demanding, complex thought problems);
- attention, action control, and so on.



Legend: CPC = cognitive personality characteristics or traits of gifted individuals (predictors); NCPC = Non-cognitive personality characteristics or traits of gifted individuals (moderators); SCC = Socio-cultural condition variables (moderators); CV = Criterion variables (of achievement behavior in gifted individuals).

FIGURE 9.4. Causal model of performance behavior in the gifted.

As *noncognitive personality traits*, the following concepts need to be mentioned:

- interests, task commitment, and so on;
- drive for knowledge and achievement motivation (hope for success versus fear of failure);
- strategies for coping with stress, study, and work strategies;
- learning style, strategies of working memory, and so on.

The following items should be considered in the procedure of assessing *sociocultural conditions of the learning environment* or ecopsychological determinants of the development of talent, and the achievement behavior of gifted children and adolescents:

- quality of stimulation and expectation pressure of the social environment;
- reaction of peers, as well as teachers, parents, and siblings, to successes or failures of gifted students;
- socioemotional climate in the family and at school;
- sociometric peer status, teaching and instructional style;
- incidental factors, critical life events, and so on.

Finally, depending on the goals and/or purposes of the concerned gifted program, the following variables come into question as *criteria* of the talent search:

- school grades or other achievement indicators (e.g., test results, teacher ratings, grade-point average [GPA])

- success criteria related to a specific program for especially capable students (e.g., achievement variables in math or science courses);
- indicators of subjective personal gains, satisfaction with the support program, and so on.

If at all possible, life data, questionnaire data, and test data (according to Cattell, 1971) should be employed in the talent search. However, the different scale qualities must be considered in the data analysis.

The identification of gifted children and adolescents generally occurs in a procedure involving several steps. First, there usually is a *screening* process, which may be performed on the basis of teacher checklists or parent nominations for preschoolers, whereas older students are occasionally requested to nominate themselves. The most common method is probably the use of teacher or parent checklists (with or without rating scales), which are based on the operationalism of behavioral characteristics of domain-specific talents. In this way, a range as broad as possible of cognitive and motivational behavior traits is determined, which provides information about the presumed talent and assessed performances. Because ratings and other "soft" data can be assumed to be less accurate than test data, the screening should attempt to "lose" as few gifted candidates as possible (for a gifted program). This can be prevented through the conscious inclusion of none-too-small "false hits," It will not be until the second or third selection step – with the aid of more accurate diagnosis instruments that are, however, more limited in breadth – that a final selection can be made. As examples of *multidimensional* conceptualized measurement instruments, Sternberg's Triarchic Abilities Test (Sternberg, 1993; Sternberg, Castejón, Prieto, Hautamäki, & Grigorenko, 2005) and the Munich High Ability Test Battery, by Heller and Perleth (1999) are mentioned here.

Using the strategy described previously, the bandwidth–fidelity dilemma inevitably becomes a problem, as it is constantly encountered in personnel decisions (Cronbach & Gleser, 1965). Furthermore, the question of which type of error is more tolerable must also be addressed. It is well known that all selection decisions are fallible, so all that is left is to choose the lesser evil in the concrete decision situation. The risk of *type I errors* (alpha errors) exists in identifying someone as gifted when they are not. The risk of *type II errors* (beta errors) exists in failing to identify someone as gifted when indeed they are. The first type of error can be reduced by making the criteria more rigid; the second, by making them less strict. Simultaneous reduction of both types, however, is not possible. To maximize *individual* usefulness in a gifted program, for example, one decides to minimize the beta error. Occasionally, it is justifiable and sensible to reduce the alpha error, for example, in determining a sample for a study (of course, with voluntary participation). It should carefully be considered whether or not the research questions could be served just as well by using a *classification strategy* instead of a *selection strategy*. More discussion of the decision paradigms mentioned here, and elsewhere, is given in Cronbach and Gleser (1965), Wiggins (1973), Heller (1989), Hany (1993), or Sternberg and Subotnik (2000). Finally, one should be alerted to the regression effect of retesting when conducting successive identification procedures.

The quality of such an identification strategy can be evaluated on the basis of Pegnato and Birch's (1959) suggested criteria of effectivity and economy. The *effectivity* is considered to be the percentage of those students who are correctly identified as gifted during the screening. The *efficiency* or economy can be considered as a measure of the effort necessary for the total identification process. When trying to find all gifted persons, priority would be given to the first criterion (effectivity).

Instructional Strategies and Favorable Social (Learning) Environments Needed for Gifted Education

The transformation of ability potential into adequate scholastic or academic performance necessitates motivational learning and performance prerequisites on the part of the individual, as well as a supportive learning environment. What does *learning environment* mean?

A supportive or "effective" learning environment is to be understood as the customary *comprehensive stimulating social* (family, school, extracurricular) environments in which children and adolescents grow up. What are the distinguishing characteristics of effective or "creative" learning environments compared with less creative social environments? An empirical effort to answer this question can be made by comparing especially successful teachers with those who are less successful. One finds a high level of flexibility in the instructional practices of the successful teachers and a more accepting approach to the individual differences among their students. Compared with less successful colleagues, the effective teachers demonstrate a more positive attitude toward especially capable children and adolescents. This finding, made by researchers working in the United States (cf. Baldwin, 1993; Gallagher, 2000; Gallagher & Gallagher, 1994; Peterson & Fennema, 1985), has been replicated in scientific gifted program evaluation studies conducted in Germany (e.g., Heller, 2002; Heller & Reimann, 2002; Neber & Heller, 2002).

The postulation of a fit between individual learning needs and learning opportunities with instructional and support conditions provides us with a double objective: to transform individual learning potentials into corresponding scholastic or academic achievements (essentially a function of personality development) and just as importantly to maximize this learning potential by enabling independent and lifelong learning. These tasks correspond to the goals of adaptive instruction, which strive to hamper students' inabilities and increase their individual ability potentials (Corno & Snow, 1986). By stimulating and optimizing the learning processes through individually appropriate performance demands (e.g., task difficulty), the underchallenging of gifted students and the overtaxing of weaker students can be avoided. This can only be accomplished through sufficient "internal" (instructionally integrated) and/or "external" (scholastic/educational) *differentiation measures*. As a result, students with gaps in their knowledge, or so-called previous knowledge deficits caused by the inadequate utilization of learning opportunities, can be better encouraged to become more successful (e.g., through remedial learning) than those students with weaker talents. Among the latter, the treatment efficacy, according to investigative findings by Helmke (1992), is substantially less favorable (Helmke & Weinert, 1997).

Internal differentiation stipulates that learning tasks become the most important components in the promotion of talent and giftedness. The transformation of an individual's ability potentials into corresponding feats of excellent achievement necessitates tasks that offer a grade of difficulty lying on the boundaries of the individual's capabilities in order to make them sufficiently challenging. This need does not only correspond to common experiences found among highly talented adolescents, but it has also been confirmed by scientific investigations (Benbow & Arjmand, 1990; Gruber & Mandl, 2000).

To guarantee the quality of educational learning environments with respect to instructional differentiation measures, the following learning conditions are of substantial importance:

- Encouragement of an *active* role for the student through self-selected learning material and/or student-selected designs of their learning processes. This involves a selection of learning and problem-solving strategies emphasizing the objective to attempt new solution methods and find original solutions.
- A continuous *diagnostic evaluation of individual learning progress* to determine the level of knowledge attained and the requirements for further learning progress. In this case, achievement assessment in the form of report cards is less suitable.
- Securing an *explorative variety* of learning sources and materials to encourage self-initiated discoveries and conclusions.
- *Individualization of learning processes*, that is, making individual learning courses and paces possible, freedom to base the subject matter of activities on one's interests. These learning goals are achieved through the lucidity of learning courses and learning progress, as well as through individualized (teacher) feedback.

In attempting to formulate effective or creative (scholastic) learning environments, the fact that students are not only influenced by their respective instruction and its characteristic qualities must be taken into account – despite the salient importance of the teacher being primarily responsible for the instructional process. Students are also influenced by the direction that the instruction follows and how individual characteristics affect their learning behavior. Each form of instruction is more or less a product of interaction. Regarding the promotion of the gifted and talented, it is not only the interactive patterns of cognitive and noncognitive student characteristics (i.e., motivation and self-related concepts) that are to be considered, but also person–environment interactions.

PROGRAMMING AND ASSESSMENT

How do we translate the theoretical MMG or its extended version MDAAM into practice and ensure that gifted programs have the necessary educational and social learning environment? How do we modify the different types of educational and enrichment programs offered to gifted students (both in schools and elsewhere) in terms of content, process, product, and a conducive and stimulating learning environment to promote creativity, personality, and motivational traits? It is also necessary to have innovative modes of assessment in a gifted program to realize gifted potential, particularly in terms of excellent performance and creative products.

Currently, a variety of programming models, both part- and full-time, provide gifted children with instruction to fulfill their needs and potential. They present strategies and curricula of all types, many claiming to be "ideal" for highly gifted and talented students. The part-time programs in Europe, the United States, or East Asia include pull-out programs offering educational enrichment, honors classes, after-school programs, specialized camps, and summer schools featuring special coursework. The better known programs, such as the Center for Talented Youth (Institute for the Academic Advancement of Youth at The Johns Hopkins University; see Campbell, Wagner, & Walberg, 2000), focus on acceleration. Summer courses also include science and technology programs similar to those offered by many American universities (iD Tech Camp), Weizmann Institute of Science in Rehovot Israel (cf. Maoz, 1993; Subhi & Maoz, 2000), or the German Pupils Academy (Neber & Heller, 2002; Wagner, Neber, & Heller, 1995). Passow (1993) provides an international perspective on programming. For a greater overview, see Heller, Mönks, Sternberg, and Subotnik (2000, pp. 671–828).

Full-time programs could be specially designed gifted classes in regular schools, as seen in Singapore (Lim, 1996a) or Germany (Heller, 2002), or special high schools for the gifted, such as Bronx Science and Illinois Math and Science Academy in the United States (see Passow, 1993), and the Israel Arts and Science Academy (see Passow, 1993; Subhi & Maoz, 2000). These gifted classes and schools run an intensive curriculum of subjects with emphasis on sophisticated topics and enrichment activities. Such schools usually organize mentor programs in which students are matched with professionals in the community for special learning experiences (Lim, 1996b, 2002; Zorman, 1993).

The Curriculum of Gifted Programs

In a gifted program, a specially designed differentiated curriculum is needed to address and nurture gifted characteristics, such as abilities, motivations, and interests. Such a strategy transforms gifted potential into excellent scholastic performance and creative performance and products (cf. Sternberg, 1997; Sternberg & Grigorenko, 1995). This type of an optimized program has to be qualitatively (rather than quantitatively) different than the basic curriculum.

According to VanTassel-Baska (1988, 1992), differentiated curricula in terms of content, process, and products respond to diverse characteristics of gifted learners by accelerating the mastery of basic skills. This is done through testing-out procedures and reorganization of the curriculum according to higher-level skills and concepts. We can engage students in active problem-finding and problem-solving activities and research by providing opportunities for them to focus on issues, themes, ideas, and making connections within and across systems of knowledge.

Many successful gifted programs tend to modify content through acceleration in individual subjects, or thematic, broad-based, and integrative units. An entire content area arranged and structured around a conceptual framework can be mastered in much less time than is traditionally allotted (VanTassel-Baska, 1988, 2000). In an integrated curriculum, materials can provide a balance of content and process considerations, including an emphasis on original student investigations, concept development, and interdisciplinary applications. Current special schools and summer programs incorporate expertise very well by providing advanced knowledge. For a prominent German example, see the well-evaluated G8-model on the basis of MMG in Baden-Württemberg (Heller, 2002; Heller, Osterrieder, & Wystrychowski, 1995; Heller & Reimann, 2002). These programs, however, often do less well in terms of creativity, transforming gifted potential into excellent performance, and creative products with applications in real-life contexts.

Learning and Teaching Problems Within Gifted Programs

Acceleration is but one of the means used to stimulate gifted students to excel. Gifts can also be effectively actualized through independent research and projects (modification of product). Students with exceptional aptitude in a particular field or subject can be stimulated by activities to demonstrate their abilities and challenged to achieve peaks of excellence. Thus, we effectively support independence among the students in exploration, discovery learning, and creative problem solving.

In terms of modified process, the gifted as a group comprehend complex ideas more easily and learn more rapidly and in greater depth than their peers. Some may exhibit different interests from those of their peers, whereas others may prefer time for in-depth exploration to manipulate ideas and draw generalizations from seemingly unconnected concepts. Consequently, teachers of the gifted need to integrate traditional subject areas (math, science, reading, language, and social studies) in ways that support and extend their interests and development. The gifted can then look into real-life problems and consider issues with societal implications. Teachers also have to establish a climate that encourages the students to question openly, exercise independence, and use their creativity to be all that they can be. Changes in assessment will require the gifted to exhibit skills and not just content mastery.

Products are the "ends" of instruction. Encouraging the gifted to do projects and portfolios in thematic units of integrated curriculum and concept-based instruction emphasizes the scientific and research process within an integrated framework (e.g., exploring a topic, planning how to study it and carrying out a study, judging results, and reporting). These methods encourage students to take an active role in their own learning and emphasize using problem-solving strategies to attempt new solution methods and find original solutions (Heller, 1999). Projects also expand opportunities to address real problems, concerns, and audiences; to generalize, integrate, and apply ideas; and to synthesize rather than summarize information. Students acquire an integrated understanding of knowledge and the structure of the disciplines through this process. Projects and portfolios also promote intra- and interdisciplinary learning, as well as provoke divergent and complex reasoning (Stepien, Gallagher, & Workman, 1993; Wiggins, 1989). Research opportunities associated with Type III activities are also promoted through the use of projects and portfolios (Renzulli & Reis, 1985, 1994, 2000).

The modification of such content, process, and product requires a high level of flexibility in the instructional practices of the teachers. Instruction is inquiry-oriented, using strategies like problem-based learning and Socratic questioning. Students are thus able to construct their own understanding of the subject in such a way that encourages the application of appropriate processes to new situations. Through guided questions by the teacher, collaborative dialogue and discussion with peers, and individual exploration of key questions, the gifted can grow in the development of valuable habits of mind that are found among scientists and researchers – namely skepticism, objectivity, and curiosity (Sher, VanTassel-Baska, Gallagher, & Bailey, 1992). With these features firmly in place, a community of inquiry in the classroom can then be created.

Teachers play a vital role in a gifted program. The research of Csikszentmihalyi (1999; Csikszentmihalyi, Rathunde, & Whalen, 1993; Csikszentmihalyi & Wolfe, 2000) on creative lives (e.g., gifted and creative people who have achieved their potential, won Nobel Prizes) has shown that some have considered particular high school and university teachers as a source of inspiration. These were the teachers who showed care and concern for their students. Teachers must be able to give their talented students intellectually demanding, rigorous, and challenging activities in such a way that they can be treated as fun rather than as chores. Such teachers are hard to come by – they have to be very interested in the gifted, and they must mutually share research passion with students. It is of utmost importance to have such teachers in a gifted program, both at the high school and at the university levels (cf. Arnold, 1994; Heller & Viek, 2000; Subotnik & Steiner, 1993, 1994).

As mentioned previously, to ensure the success of a differentiated curriculum involving content, process, and product, the support of a conducive and creative teaching–learning environment featuring innovative assessment modes is needed. The learning environment requires an interaction of cognitive and noncognitive student characteristics (i.e., motivation and self-related concepts), as well as interaction of person and environment (Gruber & Mandl, 2000; Heller, 2002). Creative and stimulating environments provide new insights for students, such as those available in universities, research centers, think tanks, and schools like Bronx Science (Csikszentmihalyi, 1996, 1999; Csikszentmihalyi & Wolfe, 2000). These environments have the ability to inspire and nurture creative ideas by providing freedom of action and conditions that arouse attitudes of creativity in the gifted, such as curiosity, risk taking, persistence, perseverance, and inner motivation.

Assessment Needed for Gifted Programs

Novel assessment modes suitable for a differentiated curriculum of content, process, product, and environment have to be authentic in nature, student-based, and portfolio-driven, rather than teacher-directed assignments and standardized tests. These novel performance assessment techniques and authentic assessments are better for evaluation, and they provide continuous diagnostic feedback to students, with greater emphasis on critical thinking and creativity. They can make use of real-world problems for gifted students to demonstrate understanding and transfer of key ideas and processes that mirror problem solving in real-life contexts. Assessment, therefore, reflects the interdisciplinary challenges of real-life situations and simultaneously recognizes and values the multiple abilities of gifted students. Assessment must also tolerate varied learning styles and diverse backgrounds. Gifted students can also collaborate in their own assessment, because many have high standards and expectations of themselves. It is possible to work out an optimum combination of self, peer, teacher, and mentor assessment. As pointed out by Tombari and Borich (1999), authentic learning and assessment enhance intrinsic academic motivation. Characteristics of gifted students that are nurtured through authentic assessment include intrinsic motivation, goal directedness, and persistence and preference for independent learning (Moltzen, 1996).

CONCLUSION

The present and future of identification/talent search and gifted education will primarily reflect the advances made in theoretical and empirical research with increased levels of quality. Through the examples set by expertise research and cognitive psychology, along with tried and tested psychometric models, it becomes clear that interdisciplinary approaches to the study of giftedness are mediators in tandem with new theoretical perspectives in related fields of giftedness research that are readily convertible into practice.

Furthermore, cross-cultural studies in gifted education (cf. Hernández De Hahn, 2000) offer the possibility to revise older theories and to gain a broader understanding of special needs concerning identification and programming. Increasing globalization demands international perspectives. When we are able to understand the chances being offered here, gifted education will not only help to secure our economic living conditions in the third millennium, but it will also provide a salient contribution to our understanding of other cultures and their needs, as well as the understanding and validation of giftedness models and empirical findings in the field.

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