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# The Munich High Ability Test Battery (MHBT): A multidimensional, multimethod approach

KURT A. HELLER[1] & CHRISTOPH PERLETH[2]

## Abstract

After a brief introduction the theoretical basis of the Munich High Ability Test-Battery (MHBT) will be outlined in the first part of the article. The MHBT has been developed in the framework of the Munich longitudinal study of giftedness and talent. The MHBT includes not only cognitive predictors measuring several dimensions and types of giftedness concerning intellectual, creative or social abilities etc., but also giftedness-relevant non-cognitive personality and social moderators measuring interests, motivations, learning emotions, self-concepts or family and school climate, educational style, quality of instruction, etc. The MHBT-instruments (different scales and dimensions) are described in greater detail.

In the second part of the article, after dealing with the objectivity, the reliability, and the validity of the MHBT, the authors discuss the standardization procedure including the development of grade-based T-norms respectively as well as several talent-profiles, e.g. of gifted achievers vs. underachievers, intellectual, creative, social talents or linguistic, math, science talent profiles etc. Finally, examples of talent search for gifted programs and case studies on the basis of MHBT should illustrate multidimensional identification procedures.

The MHBT fulfills the most relevant assessment tasks belonging to the gifted educational and counseling practice. The usefulness of the MHBT in the framework of giftedness research as well as of gifted program evaluation studies has also been proven in the last decade. Hence the MHBT offers many opportunities to assessing giftedness and talent.

Key words: Diagnosis of Giftedness, Identification, Munich High Ability Test Battery (MHBT), Munich Model of Giftedness (MMG), Talent Search

[1] Prof. Dr. Kurt A. Heller, University of Munich, Department of Psychology, Leopoldstr. 13, 80802 München, Germany; email: heller@edupsy.uni-muenchen.de

[2] Prof. Dr. Christoph Perleth, University of Rostock, Institute of Educational Psychology, August-Bebel-Str. 28, 18051 Rostock, Germany; email: christoph.perleth@uni-rostock.de

## Introduction

The instruments of the Munich High Ability Test Battery – in German: *Münchner Hochbegabungstestbatterie (MHBT)* – have been developed within the framework of the Munich longitudinal study of giftedness (Heller & Hany, 1986; Heller, 1990, 1991b, 1992/2001; Heller & Perleth, 1989; Heller, Perleth & Sierwald, 1990; Perleth, Sierwald & Heller, 1993; Perleth & Heller, 1994). Meanwhile selected scales used in the mentioned study are published in the MHBT by Heller and Perleth (2007a/b). Two MHBT-forms are available (in German): the MHBT-P for primary school level (grades 1-4) and the MHBT-S for secondary school level (grades 5-12). MHBT-translations into Chinese, Korean, and Thai are in process since 2006. But several MHBT-scales including KFT-HB (German version of the Cognitive Abilities Test (CogAT) for highly gifted students) are used not only in the mentioned Munich longitudinal study of giftedness started in 1985/86 but also in other investigations, e.g. on the role of creativity in science and technology (Heller, 1991a, 1995a/b, 2002a, 2007; Hany, 1994), in several gifted program evaluation studies (Heller, 2002b, 2004; Neber & Heller, 2002; Heller & Reimann, 2002) or with respect to cross-cultural studies (Heller & Perleth, 2004; Perleth & Heller, 2007), among others.

The Munich longitudinal study of giftedness pursued three main goals:

1) the development and trial of assessment instruments for the reliable and valid identification of gifted students (grades 1 to 12+);
2) the analysis of achievement behaviors of gifted students under various conditions (variations of situations and demands);
3) the longitudinal analysis of individual developmental processes of gifted children and adolescents including positive and negative socialization influences, critical life events, etc.

Methodological problems of identification depend not only on the definition of giftedness and talent but also on the employment purpose. Hence at first the Munich Model of Giftedness (MMG) will be described as reference model of the MHBT; for greater detail see Heller and Hany (1986); Heller (1992/2001, 2004, 2005); Heller, Perleth and Lim (2005). Then the structure of the MHBT including the scales (tests and standardized questionnaires) and factors analyzed will be described in greater detail. Examples of talent searches for gifted programs and individual case studies illustrate the identification design using the MHBT for different diagnostic purposes. Finally, the function of the MHBT in the practice of gifted counseling and education as well as in gifted program evaluation and talent research will be discussed.

## Conceptual and Theoretical Perspectives

If one considers “giftedness” or “talent” – both terms used here simultaneously – to be the product of interaction between genetic and environmental factors, then – assuming differential influences on both sides – different types of giftedness or talent are to be expected. Gardner (1983), with his multiple intelligence theory, postulates seven (recently even nine or ten) types of giftedness. Renzulli's three-ring model of giftedness (1978) has been expanded by Mönks and van Boxtel (1985) to six factors including the social settings family, school,

and peers. As seen in Figure 1, a general causal model can be sketched which also includes environmental factors. Conceived as a diagnostic-prognostic model, the predictor (giftedness) is on the left side with the performance behavior as criterion on the right.

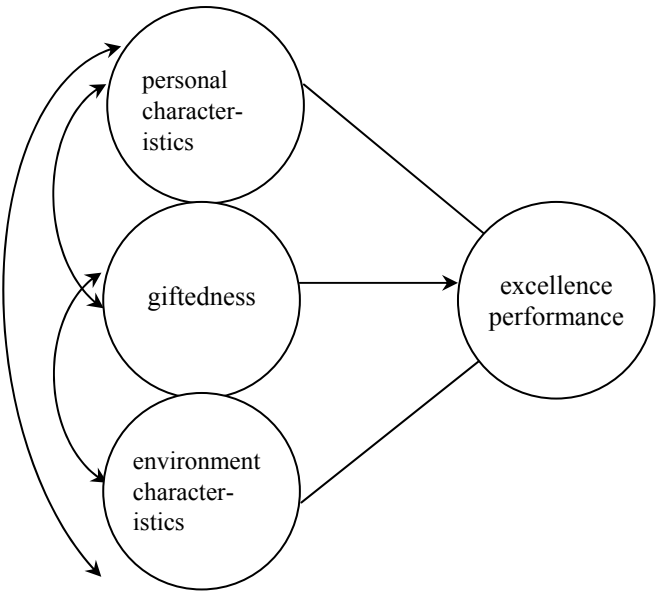
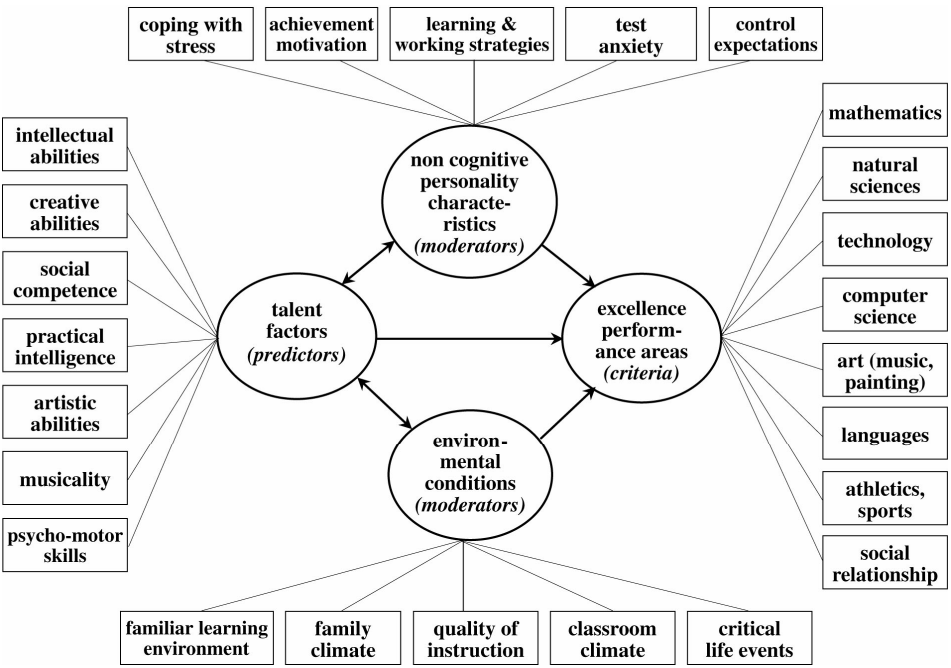



**Figure 1:**
Causal model of performance behavior in the gifted and talented
(according to Heller & Hany, 1986, p. 69)

Motivational and other non-cognitive personal traits which influence the relationship between ability or talent factors (predictors) and performance areas (criterion) in a relatively constant manner are important "mediators", i.e. they serve as so-called moderators comparable to the "catalysts" in Gagné's (2000) DMGT-conception. The moderators influence the transition of individual potentials (predictors) into performance (criterion) in various domains. For diagnostic purposes the moderators often play an indispensable role for explaining the relationship between predictors and criteria, e.g. the causal analysis of underachievement; see Figure 2. According to the MMG, giftedness or talent is conceptualized as a multifactorial ability construct within a network of non-cognitive (motivations, self-concepts, control expectations, coping strategies, etc.) and social moderators, as well as performance-related factors. For diagnostic purposes, the differentiation between predictor, criterion, and moderator variables is of particular interest.

**Figure 2:**
The Munich Model of Giftedness (MMG) as an example of multidimensional, typological conceptions of giftedness




***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

## Instruments of the MHBT

The MHBT has been developed on the basis of MMG which served as reference model. Therefore, the tests and questionnaires of the MHBT represent different scales measuring not only various aspects and types of giftedness (which serve as predictors) but also various non-cognitive personality and social-environmental learning conditions (which serve as moderators). The MHBT contains two dozen tests and standardized questionnaires for the differential assessment of the predictor and moderator variables illustrated in Figure 2. These variables are mostly relevant to the promotion and development of giftedness and talent. Multiple predictors and moderators are advocated because the excellence criterion is considered to be complex (see Figure 2).

The criterion excellence performance can be measured by means of school achievement tests and/or teacher ratings (e.g. school grades), etc. For a new performance-based assessment system see VanTassel-Baska, Feng and Evans (2007). Such scales are not included in the MHBT. In the diagnosis-prognosis paradigm, the criterion is to be predicted; see Heller (1989).

Furthermore, the checklists of the MHBT facilitate a rough estimation of individual talent levels for children and adolescents in the following six areas: intelligence, creativity, musicality, social competence, and psycho-motor ability, and can be used in the screening phase (see Table 2 below). For the complete MHBT including information about the test and questionnaire dimensions as well as the target age groups (grades) see Table 1.

**Table 1:**
The complete MHBT (sub)scales and selected dimensions of MHBT-P and MHBT-S

| MHBT-scales | | MHBT-dimensions (selection) | grades |
|---|---|---|---|
| ***Checklists (teacher ratings):*** | | | |
| Checklist re. **intellectual giftedness** | | thinking and learning capabilities, knowledge, etc. | 1-12+ |
| Checklist re. **creative giftedness** | | creative thinking, originality, etc. | |
| Checklist re. **musicality** | | acoustic sensibility, pitch differentiation, etc. | |
| Checklist re. **social competence** | | cooperation skills, leadership, etc. | |
| Checklist re. **psycho-motor ability** | | dexterity, hand skillfulness, etc. | |
| ***KFT-HB 3:*** | | | |
| **V1** | (vocabulary) | verbal abilities | 3 |
| **V2** | (word classification) | verbal abilities | |
| **Q1** | (comparison of quantities) | quantitative (mathematical) abilities | |
| **Q2** | (equation forming) | quantitative (mathematical) abilities | |
| **N1** | (figure classification) | nonverbal (technical-constructive) abilities | |
| **N2** | (figure analogy) | nonverbal (technical-constructive) abilities | |
| **GL** | (total score) | cognitive abilities level (intelligence) | |
| ***KFT-HB 4:*** | | | |
| **V1** | (vocabulary) | verbal abilities | 4 |
| **V2** | (word classification) | verbal abilities | |
| **Q1** | (comparison of quantities) | quantitative (mathematical) abilities | |
| **Q2** | (equation forming) | quantitative (mathematical) abilities | |
| **N1** | (figure classification) | nonverbal (technical-constructive) abilities | |
| **N2** | (figure analogy) | nonverbal (technical-constructive) abilities | |
| **GL** | (total score) | cognitive abilities level (intelligence) | |

*continued*

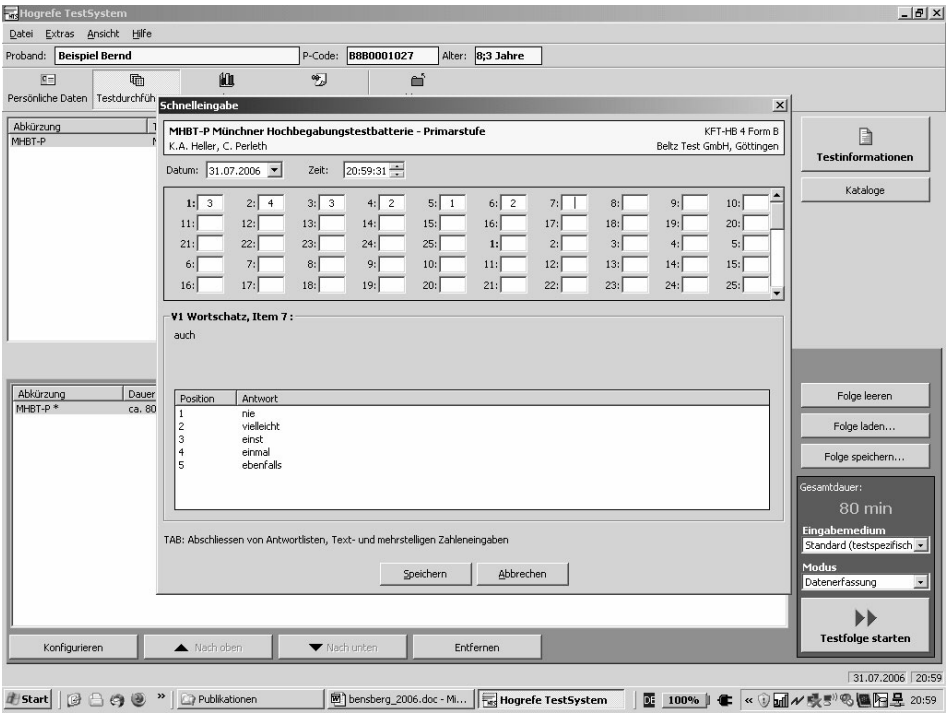
| MHBT-scales | | MHBT-dimensions (selection) | grades |
|---|---|---|---|
| ***MHBT-inventory for primary school level (MHBT-P):*** | | | |
| **KRT-P** | (questionnaire of creativity) | originality, flexibility, etc. | 1-4 |
| **SK-P** | (questionnaire of social competence) | social cognitions | |
| **LM-P** | (questionnaire of achievement motivation) | hope for success vs. fear of failure | |
| **AV-P** | (questionnaire of working behavior) | attentiveness, control of thinking processes, etc. | |
| **KA** | (questionnaire of causal attribution) | success vs. failure attributions | |
| ***KFT-HB 4-12:*** | | | |
| **V1** | (vocabulary) | verbal abilities | 4-12+ |
| **V2** | (word classification) | verbal abilities | |
| **Q1** | (comparison of quantities) | quantitative (mathematical) abilities | |
| **Q2** | (equation forming) | quantitative (mathematical) abilities | |
| **N1** | (figure classification) | nonverbal (technical-constructive) abilities | |
| **N2** | (figure analogy) | nonverbal (technical-constructive) abilities | |
| **GL** | (total score) | cognitive abilities level (intelligence) | |
| ***MHBT-inventory for secondary school level (MHBT-S):*** | | | 5-12+ |
| **AW** | (unfolding test) | spatial reasoning | |
| **SP** | (mirror images) | spatial cognition | |
| **APT** | (tasks of physics and technology) | problem solving in physics and technology | |
| **KRT-S** | (questionnaire of creativity) | originality, flexibility, etc. | |
| **SK-S** | (questionnaire of social competence) | social cognitions | |
| **IFB** | (questionnaire of interests) | preferences of interests | |
| **FES** | (questionnaire of thirst for knowledge) | curiosity as a preliminary form of striving for knowledge | |
| **LM-S** | (questionnaire of achievement motivation) | hope for success vs. fear of failure | |
| **AV-S** | (questionnaire of working behavior) | attentiveness, control of thinking processes, etc. | |
| **SCHUL** | (questionnaire of school climate) | aspects of school climate | |
| **FAM** | (questionnaire of family climate) | aspects of family climate | |

***Legend:***

KFT-HB = Cognitive Abilities Test for Highly Gifted Students
V = Verbal abilities
Q = Quantitative (mathematical) abilities
N = Nonverbal (technical-constructive) abilities
-P = Primary school level
-S = Secondary school level

## Scoring of the MHBT-results

The scoring of the tests and questionnaires of the MHBT-battery is exclusively done with the help of a computer software. Therefore, the usual scoring with the help of stencils and norm tables is not possible. After entering each answer of the respective student in a formular (see Figure 3) one gets at once a lucid profile evaluation for founded analysis in the frame of the respective diagnostic problem – without complicated calculation and long winded work with norm tables (see Figure 4).



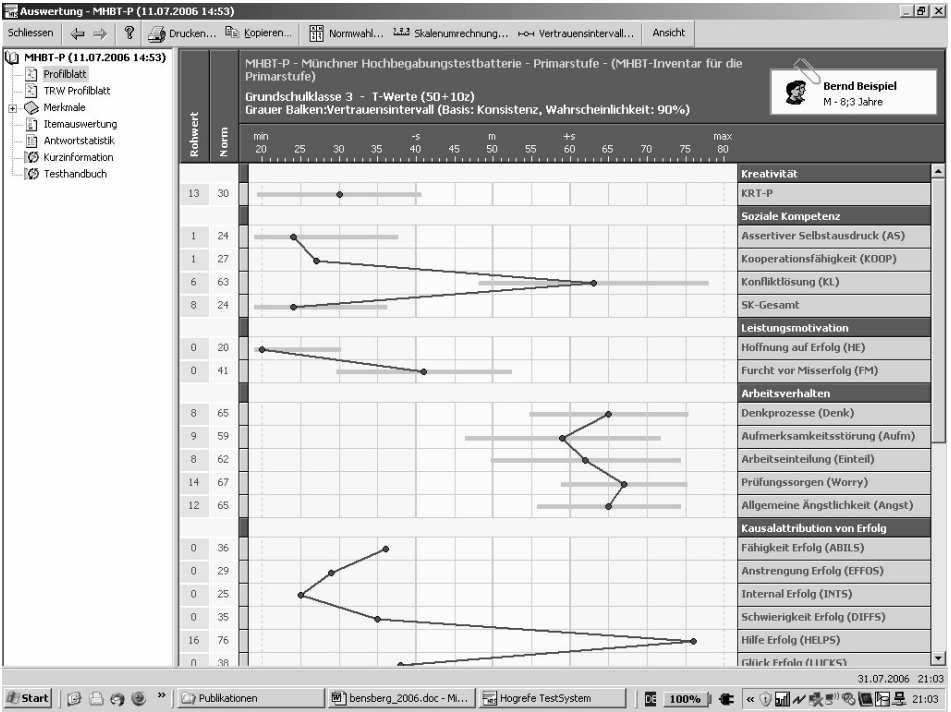

***Legend:*** Software is available in German only. The screenshot shows the input mask where the chosen alternatives for the 25 items of subtest "V1 Wortschatz" (vocabulary) of the KFT-HB can be entered. You can either save ("Speichern") or cancel ("Abbrechen") the data of this mask.

**Figure 3:**
Data gathering with the scoring computer program of the MHBT (fictive example)

This scoring computer program is integrated in the Hogrefe-Testsystem and offers a number of advantages for the practitioner:

- Scoring can be more easily done and mistakes can be avoided – as long as one correctly enters the data.
- In view of the complex structure of the MHBT with many dimensions and subscales this facilitation of the scoring gains even more importance.
- The computer program provides diverse possibilities of data management and the results or profiles of several students can be shown at the same time and this way can be very easily compared.

The scoring program can be installed only once on exactly one personal computer and for each case one has to pay a certain amount of licence fee. For this purpose one has to buy a certain amount of scoring cases. This procedure may be unfamiliar to those who have collected experiences only with traditional scoring programs which were available extra to the conventional scoring „by hand". However, even if one has to pay a licence fee for each




***Legend:*** Software is available in German only. For an explanation of the abbreviations of the different scales (blue fields on the right) see table 1 above. The red points and lines show the profile (T-scores), the grey whiskers represent the 90 % - confidence intervals on the basis of consistence reliability.

**Figure 4:**
Profile analysis with the scoring computer program of the MHBT (fictive example)

use or scoring process, the scoring of the MHBT is not per se more expensive in comparison with conventional tests and questionnaires. For scoring the data of each student one has to pay just 3 Euro. Together with the costs of the maximum of 3 answer sheets (0.25 Euro each) the total costs for each case is rather moderate, especially if one considers the time one usually needs for scoring.

To prevent abuse and also because of the layout of the computer program in the framework of the Hogrefe-Testsystem it is not possible to edit the data of a single answer after the answer record of a certain case/student has been stored. It is, however, possible to inspect the answer pattern of a single case in detail. With other words: One can exactly reproduce which alternative a certain student crossed out but one cannot change or correct the answer of a single item after storing the respective case.

In the manual of the MHBT one can find a number of examples for individual diagnostics with varying contexts and for different counseling problems. This should support the practical use of the MHBT. The manual also contains examples for talent search, an example of which is given at the end of this article.

## Psychometric quality of the MHBT-scales

With respect to the objectivity no bigger problems should arise with trained test instructors as detailed instruction is available. All tests and questionnaires are suited for application in groups so that the instructor-testee-interaction is reduced to a minimum. Nearly all scales use multiple-choice-format, the evaluation of the answers is done with the help of a special computer software. Of course, the teacher checklists available with the MHBT own a lower degree of objectivity, above all because the ratings given depend on the experience of the specific teacher.

Depending on the relative test or questionnaire in the framework of the Munich Study of Giftedness as well as for the standardization sample reliability coefficients between $r = .40$ (for example for some scales of the questionnaire for family climate, FAM) and $r = .95$ (e.g. for the scales of cognitive abilities, KFT-HB) were found. The KFT-HB-scales also showed astonishingly high stability coefficients over periods of one or two years. For the rather rough teachers' checklists (screening procedure) no systematic results concerning their reliability could be collected. However, there are some findings for very differentiated teachers' ratings (some had more than 100 items for 5 domains of giftedness) showing that their predictive validity is only little (not meaningfully) higher than the rather rough ones (Perleth & Sierwald, 2001).

With respect to factorial validity we found patterns which we expected, for example the three material factors typical for the KFT (Cognitive Abilities Test): A verbal, a quantitative, and a nonverbal-figural factor. The analysis of concurrent and predictive validity of the MHBT tests and questionnaires showed middle to high coefficients with teachers' ratings, school grades, Abitur grades (final school exam), first achievement during university study as well as diverse activities and achievement in leisure time activities (i.e. extracurricular activities). For some methods and groups of predictors quite high coefficients could be found for longer periods of time: For example in the framework of the follow-up-studies validity coefficients up to $r = .79$ could be found between the KFT-HB and first achievement at university; with respect to Abitur grades we found coefficients for predictive validity up to $r = .80$ for some of the subjects. The teachers' checklists showed sufficient concordance with test results. See Figure 5 for an overview on the Munich giftedness study including the follow up, and the standardization studies.

## Standardization of the MHBT battery

For the MHBT grade specific norms have been computed on the basis of an unselected standardization sample of more than 4,000 students in total. Tables 2 and 3 should give an impression how the total standardization sample was divided for the standardization of the different scales and how the students were distributed with respect to school level, grade and sex. The German secondary school system is built up of three school types of different level: The "Gymnasium" (grade 5 to 12 or 13) is attended by about 30-40 percent of the students (11-18/19 years of age) and represents the highest level leading to university. This school form is chosen by a relatively high number of students with above average cognitive abilities. The "Realschule" (grade 5 to 10, i.e. age 11-16) represents a middle level, while the

students of the Hauptschule, all in all, show lower school achievement; here you find also a high percentage of students from migrant families.

In order to get grade specific norms which differentiate good in the upper range of the respective scales a similar technique (stratification and rectification) was used as was done in the PISA-study. That means that the sample was recruited in a way that

– an over proportional percentage of students from the Gymnasium was included,
– and a relatively small percentage of students from the Hauptschule.

For the calculation of the norms, the sample was weighted following the correct percentage of the students of the different school types of the respective federal state.

All norm tables contain T-norms which have been normalized by McCall's procedure. All tables give T-norms up to a maximum of $T = 80$, no extrapolation was used to get even higher T-norms because we are convinced that all norm tables should have an empirical foundation and should not belong to the genre of science fiction.

Further on, one finds in the manual of the test battery MHBT-profiles or standards on the basis of 332 gifted, highly achieving students as well as 134 gifted underachieving students. These profiles or standards are separately given for both primary and secondary school age students. These gifted, highly achieving students and gifted underachievers stem from different studies in which the MHBT was used.

The procedure used for standardization and computation of the norm tables was chosen in order to get a good differentiation especially in the upper range of the different scales, above all the abilities and achievement tests. For detailed profile analysis the standards/ profiles of the gifted and underachievers (see above) can be used. These standards/profiles can not only be useful for identification and counseling of individuals but also for the identification of giftedness types as well as for talent searches (see below). The profile can also be useful for a detailed analysis of moderators or factors (or catalysts) which are useful for transformation of abilities in achievement. As shown above the MHBT provides a good number of scales for different motivational and other personality factors as well as scales for relevant variables of the family or school learning environment.

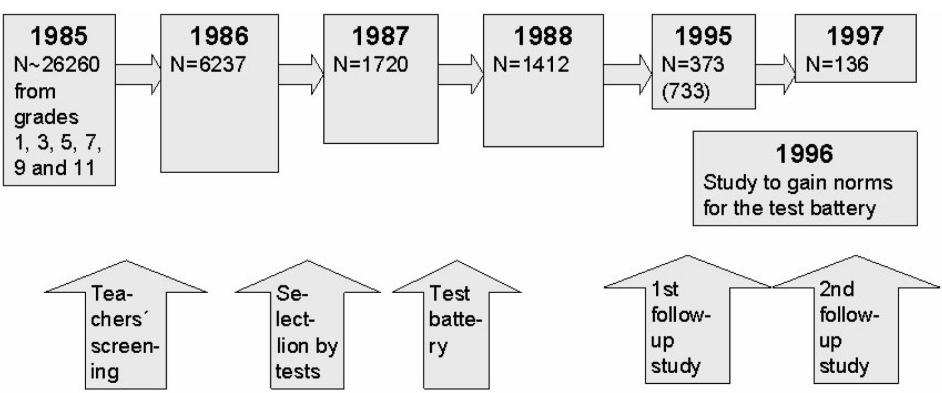



**Figure 5:**
Sample and design of the Munich Giftedness Study

**Table 2:**
Sample 1 (Standardization of the KFT-HB)

| | Primary school/ Hauptschule | | Realschule | | Gymnasium | | Total | |
|---|---|---|---|---|---|---|---|---|
| Grade | Sex | | Sex | | Sex | | Sex | |
| | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ |
| 3 | 80/76 + 318 | 71/85 + 319 | | | | | 156 + 318 | 156 + 319 |
| 4 | 161 | 161 | | | | | 161 | 161 |
| 5 | 30/33 | 35/27 | 11/17 | 22/14 | 54/32 | 45/35 | 179 | 178 |
| 7 | 38/35 | 36/27 | 20/8 | 9/9 | 55/46 | 61/47 | 204 | 190 |
| 9 | 8/17 | 7/12 | 45/35 | 36/34 | 62/56 | 58/55 | 224 | 205 |
| 11 | | | | | 80/89 | 91/77 | 170 | 168 |

*Legend*: See the main text for the different German school types; ♂ = male, ♀ = female.

**Table 3:**
Sample 4 (Standardization of the questionnaires SK-S, SP, AW, Fam, LM-S)

| | Primary school/ Hauptschule | | Realschule | | Gymnasium | | |
|---|---|---|---|---|---|---|---|
| Grade | Sex | | Sex | | Sex | | Total |
| | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ | (♂/ ♀) |
| 5 | 58 | 67 | 28 | 30 | 16 | 13 | 235 (102/110) |
| 7 | 43 | 30 | 30 | 26 | 55 | 43 | 232 (128/99) |
| 9-11 | 10 | 9 | 22 | 16 | 69 | 74 | 206 (101/99) |

*Legend*: See the main text for the different German school types; ♂ = male, ♀ = female.

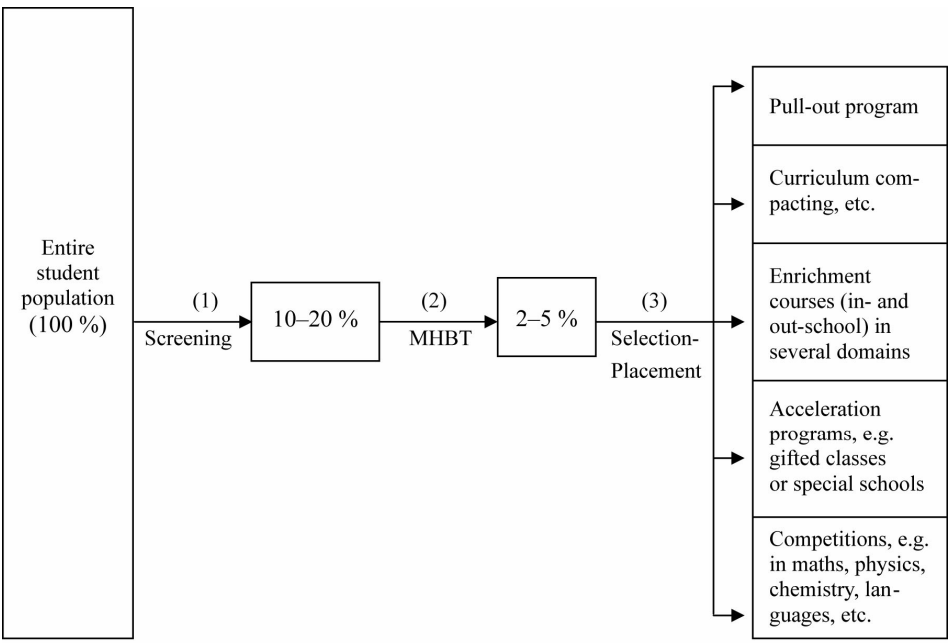
## Talent search with the use of MHBT

When regarding the diagnostic 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 gifted program fit together (Heller, 1999, 2005; Pfeiffer & Jarosewich, 2007). Talent search in this sense means individual developmental help. A comprehensive assessment approach should, therefore, be an indispensable component of every talent search (Hany, 1993; Feldhusen & Jarwan, 2000). The MHBT-instruments represent the most relevant cognitive abilities (verbal, quantitative, nonverbal, technical, space and other factors) and noncognitive personality moderators (self-concept, action control, task commitment, achievement motivation, etc.) as well as social conditions of the learning environment (family and school climate, "creative" stimulation in the classroom, quality of instruction, etc.).

The first step in the identification process is usually a *screening* on the basis of teacher checklists (with rating scales) based on the operationalism of behavioral characteristics of domain-specific talents. In this way, a range as broad as possible of cognitive and motivational traits is determined which provides information about the presumed talent and assessed performances. Since 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 the concerned gifted program. This occurs through the conscious inclusion of non-too-small "false hits".

It will not be until the second or, if necessary, the third selection step – with the aid of more accurate measurement instruments that are, however, more limited in breadth – that a final selection can be made; see Figure 6. For greater detail see Heller (2004, 2005, 2008).

The following example of talent search illustrates the identification steps mentioned above. This paradigm has been applied and validated among very able students identified




***Legend:***

(1) = Screening phase (e.g. by teacher checklists): Nomination of the 10-20 % class leaders with respect to different dimensions of giftedness and talent.

(2) = Tests and standardized questionnaires (MHBT) measuring different factors of giftedness and talent in the preselected group of the 10-20 %.

(3) = Final decision and assignment to various nurturing programs.

**Figure 6:**

A sequential strategy model of the identification of gifted and talented students for educational programs according to Heller (2000, p. 252)

through MHBT for the "Hector-Seminar", a gifted program in Mathematics, Informatics, Natural sciences, and Technology (MINT) carried out in the state of Baden-Württemberg (Germany). Depending on the main goal of the *Hector-Seminar* (furtherance of MINT-talents), at the first step, checklists have been applied for pre-selection of the top 10 % of the students in the German Gymnasium. The checklists focused on several aspects of intellectual, creative and social giftedness which are mostly relevant to MINT (see Table 4).

At the second step, the pre-selected top 10 % of the candidates of the gifted program "Hector-Seminar" have been tested by following MHBT-scales: KFT-HB V1, V2, Q1, Q2, N1, N2, AW, SP, APT, KRT-S, and SK-S (see Table 1 above). At the final step, the "Hectorians" could be recruited on the basis of a combinatory decision strategy (Heller, Senfter & Linke, 2006, pp. 13-15; Heller & Perleth, 2007b, pp. 133-140).

Using the identification selection strategy described above, one runs into the bandwidth-fidelity dilemma according to Cronbach and Gleser (1965). All selection decisions are fallible; one can only attempt to choose the lesser evil in the personnel decision. The risk of *type I* errors exists here in identifying someone as gifted when he or she is not gifted. The risk of

**Table 4:**

The first step of talent search (here in the recruiting of the "Hectorians") based on teachers' checklists

| **Possible criteria for** | | |
|---|---|---|
| **intellectual giftedness** | **creative giftedness** | **social competence** |
| • Logical/analytical thinking<br>• Abstract thinking<br>• Mathematical thinking<br>• Scientific/technical thinking<br>• Language skills (rich vocabulary, fluency of expression, talent for foreign languages)<br>• Learning ability (quick understanding, retentive memory, accurate reproduction, active learning)<br>• Powers of deduction, combination etc.<br>• Broad knowledge<br>• Consolidated special knowledge in one or more domains | • Curiosity, quest for knowledge<br>• Imagination, ability to think in alternatives<br>• Creative and inventive thinking<br>• Originality, search for extraordinary problem/task solutions<br>• Flexible thinking, spiritual agility, ability to consider a problem from various points of view<br>• Self-sufficiency, independence of thinking and opinion<br>• Interest-oriented, independent solving of problems<br>• Multiplicity of interests<br>• Stability of interests | • Social adaptability<br>• Social cognitions<br>• Self assertion, self confidence<br>• Cooperation, conflict solving, etc.<br>• Capacity for understanding, empathy, etc.<br>• Initiatives in social contexts<br>• Social accomplishments<br>• Leadership<br>• Social responsibility, integrability, etc.<br>• Popularity with classmates, etc. |

***Note:*** To assess MINT-related types of giftedness, please nominate the top 10 % of the students in your class referring to the dimensions listed above. The criteria need not be all present; it is sufficient if the student excels in some of them.

*type II* errors exists here in failing to identify someone as gifted when indeed they are. The *type I* error can be reduced by making the criteria more rigid, the *type II* error by making them less strict. Unfortunately, simultaneous reduction of both types is not possible. In order to maximize *individual* usefulness, it is better to minimize the *type II* error. For maximizing the gifted program usefulness, the *type I* error should be minimized; for greater detail see Heller (2004, 2005), Heymans and Mönks (2004).

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