

Identification of Motivated and Creative Highly Gifted People

Development of the CMAC-Test

Sabrina Schork, Franz-Josef Schmitt, Ines Langemeyer

Abstract

The following contribution deals with the environmental conditions of highly gifted and sensitive people (HGSP). Three researchers from different perspectives (physics, pedagogy, and innovation management) empathize with the target group and try to understand their experiences. From three interviews with adults, a first point of view is defined adopting the Grounded Theory methodology. Adult interviews are compared with the perceptions of an adolescent from today moving between state and private education systems. By comparing both perspectives, differences and similarities are worked out. The discussions are used to develop an online test focusing on creativity, motivation for achievement, and cognitive capacities, as these are core categories identified that seem to be highly important in combination. The empirical test is intended to provide the state education system with a simple and interactive solution to identify a large group of people who need further support. To achieve a high participation rate, the test will be designed for a maximum of one hour and the implementation and evaluation will be carried out digitally. The authors' vision is to create an adaptive environment that can effectively adjust to and educate diverse groups of learners without over- or under burdening teachers and learners. A key finding of our case-based research is that the existing school and higher education structures are not able to provide sufficient support and challenge for HGSP. Support measures for HGSP are needed as well as a new understanding of learning and teaching, so that new competencies can be built that consider people's self-regulation, creativity, and motivation for achievement, in addition to cognition and meta-cognition. Kuhl (2004, 18) explains why the capacities of self-regulation are paramount for highly gifted students. When they want to meet a challenge, they face problems that are more difficult and therefore need more persistence, resilience, and self-motivation. However, to support these special needs, teachers are often not ready or capable to do so, nor do these needs fit with the performance requirements of the regular curriculum.

Keywords: Higher Education, German Education System, High Giftedness, Creativity, Motivation for Achievement, Self-Regulation, Meta-Cognition, Cognitive Capacity

Introduction

We know today that around 2.1% of society are highly gifted with an IQ higher than 130 (Pietschnig, 2021, p. 76), and 0.1% are supremely gifted with an IQ higher than 145 (Boland & Gross, 2007, p. 159; Brackmann, 2020, p. 13; Webb et al., 2020, p. 34). Although it is known that IQ survey methods are not sufficient for identifying potentials, these techniques will continue to be used as the only reference point for the selection of gifted people (Webb et al., 2020, pp. 44-47; Brackmann, 2020, pp. 21-22). There are different types of giftedness, namely - intellectual, psychomotor, imaginative, sensory, and emotional (Brackmann, 2005, p. 40; Bouchet & Falk 2001; as cited in German-Tillmann et al., 2021, p. 229).

Gifted human beings are individuals often bearing enormous potential to solve the problems of our time and create solutions for complex problems - however, the world of the ordinarily gifted needs to support them to be able for fruitful development of their diverse potentials. Instead of encouraging and supporting (cf. Germann-Tillmann et al., 2020, pp. 8-13).

There is currently a gap in the identification and the support of the development of gifted children. This is due to the lack of holistic and overly cognitive diagnosis. There are many survey formats that seem opaque. To understand them, money must be invested, paper-based samples have to be taken and further training (time and money invested) has to be done for the analysis. The resulting complexity leads to the fact that only few people benefit from giftedness testing, sometimes erroneous conclusions are drawn (cf. Webb et al., 2021). Support is offered from associations and institutions. But the support is expensive or not always used due to a lack of understanding at the level of the parents. Parents are not always ready to accept and adjust to the special needs of the highly gifted child. Sometimes conflicts have emerged in school so that 'social integration' and the 'adjustment' of the child's behavior to the class and to the norms of the school becomes the main problem.

Our approach is motivated by three basic assumptions: 1. The support of HGSP is an important societal need that can clearly create benefits to the highly gifted ones but also to the society, 2. Adequate support should be focused on and value the characteristics of HGSP, and 3. There is a strong demand for further research in that field, especially on HGSP who did not get sufficient support in their youth.

However, recognizing HGSP in more categories than pure cognitive competence is an essential prerequisite for successful support. In a series of interviews, the authors realized that even in the field of efficient development of performance, three categories should be targeted in an online survey where highly gifted people have the potential to develop their skills. One is **creativity** (cf. problem solving), the second is the **motivation for achievement** (cf. desire, will and incentive to achieve something or to be successful), and the third is **cognitive capacity** (cf. reflected in an above-average-ability operationalized in an IQ greater than 130 as well as meta-cognition). The acronym used in the following for the combination of the three dimensions is CMAC. In addition to the CMAC, emotional affections should also be documented and analyzed to gain a first impression of the self-regulation ability.

The research hypothesis discussed in this report is: People who, in addition to their cognitive capacity, demonstrate - both high creativity and high motivation for achievements could develop better if their ambitions are selectively supported during life. This would allow

them to contribute to society as well as finding more considerable satisfaction in their own life (cf. Renzulli 1978). To support the hypothesis, an instrument is being sought and developed that can easily and quickly recognize different talents at state schools and universities and document them along the development path.

This report represents a general starting point in this important area, motivated by observations and reflections made with HGSP.

High Giftedness

In high-ability models, the emergence of exceptional performance is explained as multifactorial (Ulbricht, 2004). Most (high) ability models consider above-average intelligence as an essential characteristic of intellectual giftedness. In addition, the models often consider other characteristics of a person, such as creativity, self-confidence, interests, personal development in learning processes, sociocultural conditions, or interactions between a person and the environment. Interesting is the realization of diverse researchers that school grades are not necessarily related to the level of intelligence (Bloom, 1963; Harmon, 1963; Hudson, 1960; Mednick, 1963; Parloff et al., 1968; Richards et al., 1967; Wallach & Wing, 1969). The best-known (high) giftedness models include the Munich High Ability Model (Heller, 1990), the triadic interdependence model (Mönks 1985; as cited in Mönks & Katzko, 2005), and the Three-Ring Model by Renzulli (1978). The latter forms the basis of this paper.

Renzulli (1999), a researcher who has been engaging in the field of giftedness since the 1960s, focused his research on potentially creative and productive adults. The distinction between giftedness and creative, productive giftedness is highlighted. In the current study, further steps will be taken to work out what distinguishes productive from unproductive HGSPs and how educators can influence them. Renzulli created the Three-Ring Conception and the Enrichment Triad Model, which are meant to be interactive. Both should encourage talented adolescents to apply their abilities, creativity, and task commitment to solve personally meaningful problems.

High abilities above the average, high levels of creativity and high task commitment form the three rings of Renzulli's model. While high abilities can be measured by tests, creativity is a form of flexibility and originality of cognitive output, desire for experiences, sensitivity to stimulations and a driving force to perform, i.e., motivation for achievements. The latter one mainly forms the third ring, task commitment, where motivation is directly turned into action. Without task commitment high achievements are not possible and high giftedness stays invisible. Therefore, all three rings work together when high achievements and general observable gifted behavior is efficiently realized.

Renzulli (1978) proposed that gifted children can develop gifted behavior but, to achieve that, individual educational opportunities are needed: "Gifted and talented children can develop this composite set of traits and apply them to any potentially valuable area of human performance. Children who manifest or are capable of developing an interaction among the three clusters require various educational opportunities and services not ordinarily provided through regular instructional programs." Renzulli challenged the traditional orthodoxy that dominated the field at that time. Today, teachers can apply, for example, the Multiple Menu Model for Developing Differentiated Curriculum (Renzulli, 1988), structuring each lesson or class with objectives,

activities, strategies, products, modifications, and background material. Students create concrete products (i.e., written, or artistic) and abstract products (i.e., problem-solving strategies). The theory of Renzulli (1999) is close to Amabile (1988; 1993) focusing on domain-relevant- and creativity-relevant skills, as well as task motivation. In the following, the terms are described from Renzulli's understanding, and possible test operationalizations are derived from them.

High Sensitivity

According to the research of Aron (2021), 20% of the population is susceptible. It has yet to be discovered how many highly gifted people are also susceptible. However, Brackmann (2020: 65) emphasizes in her work that highly gifted people can be sensitive and, at the same time, highly tenacious, persistent, and resilient. Sensitivity is not welcome, recognized or supported in German culture but in China (Aron, 2021, pp. 23-25).

Cognitive Capacity

The above-average ability in the context of Renzulli's Three Ring Model focuses on how well a person scores on an intelligence test. Giftedness refers to the top one or two percent of society. Renzulli (1999, p. 69) points out two aspects of well-above-average ability: (1) general ability, which consists of traits that can be applied across all domains (e.g., general intelligence) or broad domains (e.g., general verbal ability applied to several dimensions of the language arts) and (2) specific abilities that consist of the capacity to acquire knowledge, skill, or the ability to perform in one or more activities of a specialized kind.

Universities specializing in giftedness in Germany mainly use the Fourth edition of the Wechsler Adult Intelligence Scale (WAIS-IV) by Petermann (2012) to estimate the IQ level of adults. The complementary test for children is actually WISC-V. These tests last 60-90 minutes and combine online and physical elements.

Motivation of Achievement

Terms connected to task commitment are perseverance, hard work, dedicated practice, self-confidence, a belief in one's ability to carry out important work, and action applied to one's area(s) of interest. Intrinsic motivation refers to a state in which action is taken because of an inner stimulus inherent in the activity itself, e.g. in the sensation of flow experience (Gabler Wirtschaftslexikon, 2022). "According to general interest theory, intrinsic motivation is reduced when reward conveys the perceived irrelevance of the task of competence or when the reward affords the impression that the task is unimportant". (Eisenberger et al. 1999, p. 679) Extrinsic motivators such as money or rewards can negatively affect intrinsic motivators (Deci et al. 1999). Amabile (1993; cited in Fischer et al. 2019) assumes that intrinsic and extrinsic motivation can influence each other and even add up positively. According to Ryan & Deci (2000) the creative and innovative performance of humans are strongly affected by the type of underlying motivation that are triggered by individual motives and needs. Inner assumptions can be the starting point of behaviors (Deci 1975, p. 130). In the PSI Theory, Kuhl et al. (2021) support the idea that the internal involvement of a behavior that was intrinsically motivated can be lowered by external incentives (instructions, rewards). Heyman & Dweck (1992, p. 231) state that factors promoting learning goals (emphasizing the development of competencies)

are associated with enhanced intrinsic motivation, and that factors promoting performance goals (emphasizing the evaluation of competence) are associated with diminished intrinsic motivation. Bénabou, & Tirole (2003, p. 490) support the argument that “extrinsic motivation (contingent rewards) can sometimes conflict with intrinsic motivation (the individual's desire to perform the task for its own sake).” The authors report on diverse experiments supporting their argument (cf. Deci 1975; Wilson et al., 1981; Kruglanski et al., 1971; Lepper et al., 1973). One experiment was conducted by Deci (1975) and students who were paid to do a puzzle were not as likely to do it of their own free will afterwards as those who were not paid during the puzzle.

Several research studies have shown that creative, productive people are far more task-oriented and involved in their work than people in the general population (Renzulli, 1999, pp. 73-75). Finding these people therefore appears to be particularly interesting. To do this, a test is sought that can be mapped online and implicitly tap into deeper motives for action.

The short version of the Operant Motivation Test (OMT) created by Kuhl et al. (2003) is selected for this purpose. The OMT indirectly tests the implicit character or social motives. The test persons create a conditioned reaction through associations with ambiguous images by spontaneously reacting to them. The identification of the main character is elementary. Non-salient structural features in pictures are recognized. There are three motifs to choose from: attachment, achievement, and power. A motive "is a recurrent concern for a goal state based on a natural incentive, a concern that energizes, orients and selects behavior." (McClelland, 1987). Kuhl adds to this that motive dispositions are “intelligent needs” (Baumann et al., 2005). Adverse effects can be reduced by feeling, by having all processes transparent and accessible to the self.

Creativity

The standard definition of creativity from Runco & Jaeger (2012, p. 92) explains that "creativity requires both originality and effectiveness." Originality is often labeled novelty and effectiveness as usefulness, fit, or appropriateness. Lubart et al. (2003) define creativity as the capacity to produce something new and adaptive within the constraints of a given situation. The authors distinguish between fields and state that a person creative in inventing stories does not have to be creative in, e.g., a scientific field such as mathematics or drawing. The difference in creative performances can be understood within the multivariate approach. According to Sternberg & Lubert (1995), different factors, such as cognitive, conative, and environmental, contribute to creative potential. Cognitive factors refer to knowledge and information processing abilities. Conative factors refer to personality traits (i.e., risk-taking, openness, tolerance to ambiguity) and motivation (i.e., energetic strength with which a person engages in performing a task). Environmental factors (i.e., family rules, school stimulations, work values, cultural traditions) influence the development of creative capacities and creative expression. Creativity incorporates the dimensions of originality, constructive ingenuity, the ability to set aside established conventions, and a flair for devising adequate and original fulfilments (Renzulli, 1999, p. 79).

Maker (1993) distinguishes between intelligence and creativity. Both are capacities that play different roles in the phenomena of high potential depending on the nature of the problem with which the individual is confronted. Different types of problems emphasize either

intelligence or creativity. The problems that involve creativity tend to have a vague formulation, require a solution to be invented, and often do not have a single "right" answer (Besançon, 2013, p. 154). This position is consistent with the view that the distinction between intelligence and creativity is an artificial one; perhaps, there is a continuum from intellectual to creative giftedness, which is pronounced depending on the domain and the nature of the task in the domain (Runco & Albert, 1986).

According to Besançon (2013, p. 159), numerous tools have been proposed to evaluate creativity, distinguishing between measures of creative potential and actual creative achievement. Three tasks from the Torrance Test of Creative Thinking (TTCT) can be used to assess divergent thinking. These tasks evaluate the ability to generate many ideas from a given stimulus with verbal and graphic modes of expression. The first task asks for as many ideas as possible to use a given "thing" in new ways. The second task is to improve an existing product. Moreover, the third task asks to draw parallel lines. The scoring is calculated based on fluency (number of ideas), flexibility (kind of ideas), and originality (differentiation from existing ideas). In contrast to divergent thinking tasks, productive integrative tasks require the conception and development of an idea. The tasks can be verbal or graphical. The creativity is assessed with a score between 1 (not creative at all) and 7 (very creative). It is essential to have several judges to limit subjectivity. That is why the evaluation occurs in a jury of three people from diverse domains. Besançon (2013, p. 163) also introduces the Evaluation of the Potential Creativity (EPoC) test for children, which is unavailable for adults and not available in German language. For these reasons, the test is not used in this study.

Teachers tend to overlook creative students because they stand out unpleasantly. In addition, children with a high IQ are perceived as more pleasant by teachers. Studies have shown that mentoring can have a positive effect on creative people. When using the TTCT, attention must be paid to who and how the results are assessed (Kim, 2006).

Methodology

Procedure

The following section describes the methodological procedure. It started with a qualitative analysis of four in-depth interviews. The insights gained were then reflected with three of the test persons. A first online-paper test version was derived from the discussions compared with a literature review. The first test version (CMAC 0.1) was tested with seven adults. Based on the discussion of the analysis with three of the participants, a second optimized version of the paper-online test (CMAC 0.2) was designed. This version was then reflected with two adults and turned into an online-only-test (CMAC 0.3), which was then tested with six adolescents. The findings were discussed with three test people and their parents, and this discussion is in turn reflected on by the researchers involved. This led to a fourth version von the online test (CMAC 0.4). The data collection procedure thus followed a four-step-approach.

Step One. The study started with a problem analysis which is the first step in creative processes such as innovation or invention creation (i.e., Basadur, 1994; Eveleens, 2010; Maggitti et al., 2013; Plattner et al., 2009). Therefore, the Mensa Community (association of highly gifted people with an IQ greater than 130) was addressed to find HGSP to be interviewed with a structured interview. Three subjects were interviewed with a structured

questionnaire containing open-ended questions and challenges along the life course. The goal was to identify pains, gains and solutions connected to high giftedness and high sensitivity as well as to identify growth opportunities leading to individual happiness. The video interviews were recorded within Zoom, transcribed manually and verbatim, as well as analyzed with the MAXQDA software. The translation of the spoken word may be misleading or expressed differently in terms of grammar or content at one point or another. For authenticity purposes, no adjustment is made. The goal was the understanding of the childhood, youth, and adulthood from their own point of view. Those tactics could lay the foundation of support formats for HGSP. The insights and interpretations were reflected in a second call with all participants. The reflections were discussed in the interdisciplinary research team as well as documented.

Step Two. One narrative interview with a highly gifted adolescent was held against the three adult interviews. Because the German educational system could have changed over the last twenty years, another video interview with the Zoom software was conducted with a highly gifted adolescent and former member of the initiative for giftedness - a support association that offers extracurricular formats for gifted students. The male adolescent first visited a state gymnasium and then transferred to a boarding school for the gifted in Saxony. The person is also involved in various associations for gifted people. The interview was transcribed manually, but not verbatim. No reflection of the results with the test person took place because a meta-level discussion did not seem to be effective.

Step Three. Based on the insights generated from the narrative interviews, a literature review took place from which a first online plus paper survey was composed and tested with six adults at the University of Applied Sciences in Aschaffenburg (CMAC 0.1). The goal was to identify intellectual and creative achievements and potentials in less than one hour so that the type of giftedness could be classified. The LimeSurvey software was used as the survey instrument because it is compliant with the basic data protection regulation. The assessment took place at a day event of the University of Applied Sciences. The computers were equipped with front cameras which filmed the face for the entire duration of the test. The recordings were subsequently analyzed using facial action coding software. Based on the feedback of three test people, an adapted version of the questionnaire was tested with two additional adults (CMAC 0.2). And the feedback of those two adults led to a third version of the survey (CMAC 0.3).

Step Four. A third online-only version of the survey was tested with six adolescents at the Association "Initiative für Hochbegabung" (Initiative for highly gifted people) in Berlin (CMAC 0.3). The data was collected with the adolescents in one room at a school in Berlin Zehlendorf. After a brief introduction to the procedure and data management, the adolescents completed the online test and asked questions. The time taken to complete the test and the emotions while doing the tasks were documented and analyzed. It was possible to link the time, and emotions to the individual tasks executed in the online survey. The feedback provided by the test people and their parents led to a fourth version of the survey (CMAC 0.4).

Questionnaire

To enable early recognition of giftedness across all state educational institutions in Germany and thus to initiate early support in the form of special formats such as mentoring, a digital test is developed below that should take less than one hour and is easy to implement. The test is based on existing offers, supplemented by a self-developed battery of questions to identify types of giftedness. The survey combines existing tests for creativity, motivation for achievements, and cognitive capacity. The test includes depending on the version additional chapters, structured in the following Table 1:

Table 1

CMAC Versions including Structure and Chapters

CMAC-Version	Chapters
0.1	Demographics Self-Report on Fields of Giftedness and High Sensitivity Creative Potential & Application Test (Online & Paper-Pencil) Motivation for Achievement Test Cognitive Capacity Picture Puzzle
0.2	Demographics Self-Report on Fields of Giftedness and High Sensitivity Creative Potential & Application Test (Online & Paper-Pencil) Motivation for Achievement Test Cognitive Capacity Picture Puzzle
0.3	Demographics Self-Report on Fields of Giftedness and High Sensitivity Creative Potential & Application Test (Online-Only) Motivation for Achievement Test Cognitive Capacity Picture Puzzle
0.4	Self-Report on Fields of Giftedness and High Sensitivity Creative Potential & Application Test (Online-Only) Motivation for Achievement Test Cognitive Capacity Picture Puzzle Personality Learning Style Demographics

The personality was assessed with a short version of the BIG5 personality test (Rammstedt, B. & John, O., 2005). And the learning style was assessed with the Learning Style Inventory by Kolb (Beyer, 2019).

Table 2 summarizes the sources and existing tests for operationalizing the core constructs of creativity, motivation of achievement and cognitive capacity in the CMAC test.

Table 2

CMAC Sources and Tests

CMAC Dimensions	Source of Content	Test
Giftedness Types and High Sensitivity	Webb et al., 2020, p. 55-61; Germann-Tilmann, 2021, p. 2 & p. 118	Self-Report on Giftedness Types (10-likert-scale)
Creativity	Torrance, 1976 Lubart & Sternberg, 1995 Mednick 1962	Torrance Test of Creative Thinking Productive Creative Thinking Compound Remote Associates
Motivation for Achievements	Kuhl et al., 2003	OMT Short-Version
Cognitive Capacity	Formann, A.K., Waldherr, K., Piswanger, K. (2011) Liepmann, D., Beauducel, B., Brocke, B., Nettelstroth, W. (2010)	WMT-2 IST

CMAC 0.1, the first version of the 1-hour-online-paper test, was composed of three demographic questions positioned at the beginning of the survey (approx. 1 minute). Then 53 questions were asked about the constructs: intellect, imagination, psychomotor skills, sensory skills, high sensitivity, and networking following a ten-likert-scale (approx. 5 minutes). Three creative tasks were answered in the online software including the description of different ways using a cardboard box, developing a pram and writing a story. Three minutes were recommended for each task. There was to be no time pressure or coercion. The creative tasks four and five were done on paper. The task was to create a drawing on the theme of tension and a drawing with parallel lines. The analysis took place with two raters (physics and economics) using a 9-likert-scale (1: extremely unpronounced; 9: extremely pronounced). Tasks one, two and four were analyzed with the TTCT logic focusing on originality, flexibility, and fluidity. All answers matched the task, which is why the correctness of the content was not evaluated. Tasks three and five were also evaluated by two raters using a 7-likert-scale (1: not creative at all; 7: very creative). The motivation for achievement was tested with seven pictures of the OMT short version. Two raters assessed whether it was a power, achievement, or relationship motive based on the free answers to the questions "who is the main character?", "how does the main character feel?", "what is the main character doing?", "how does the story end?". Cognitive performance was assessed with an IQ-Test freely available on the internet (Sifter, 2022). After five tests, however, a bug was found in the calculation. On 11.7.2022, the contact person named on the website was contacted via email. The person reported back that there must be a standard error in the calculation. The test is still online.

CMAC 0.2, the second version of the online-paper-test, had the same structure and was paper-online based. Due to respondent's feedback and the reflections of the two raters, the OMT test was shortened to five items. As well, one of the four questions ("how does the story end?") was deleted because the fourth question did not bring any new insights into the motives. Due to a bug, the IQ-Test was replaced with eight language-independent picture tasks for reasoning composed by the WMT-2 and the IST-Screening.

In the third and online-only version of the CMAC test (CMAC 0.3), paper items 3 and 5 were omitted due to impracticality in data collection and evaluation. Furthermore, the cognitive test was expanded to twelve items, as this was the request of the test persons. In addition, a short questionnaire on the BIG5 personality test and a short questionnaire on learning types were integrated. This was the result of a further literature evaluation.

Fourth online-only-version of the CMAC test (CMAC 0.4). Feedback from other researchers at the DELFI conference 2022 led to the decision to put the demographics at the end of the test. Furthermore, it was decided to do facial action coding analysis with video material and to additionally query the emotional state of mind via a web application in future test scenarios. The results of the learning style survey did not provide sufficient insights, which is why this section will be removed from future test versions. The test CMAC 0.4 version, which is the result of this study, is roughly outlined in the appendix B.

Data Set

In the following, the interview partners are introduced. To preserve privacy, only information that does not allow any conclusions to be drawn about the subjects is given in the following Table 3a to d.

Table 3a

Narrative Interview Partners

No.	Age	Gender, Ethnic	Personal Background	Date and Type of Interaction
I1	59	Male, German	Doctor Mensa Community	14.02.22, Video Interview 22.03.22 & 06.05.22, Reflexion of the transcript and analysis
I2	44	Female, German	Architect Mensa Community	16.02.22, Video Interview 06.05.22, Reflexion of the transcript and analysis
I3	37	Female, German	School Pastor Mensa Community	16.02.22, Video Interview 06.05.22, Reflexion of the transcript and analysis
I4	17	Male, German	Pupil at a boarding school for Gifted Association for gifted youth	08.03.22, Video-Interview

Table 3b

CMAC 0.1 Test Persons

No.	Age	Gender, Ethnic	Personal Background	Date and Type of Interaction
15	24	Male, German	Bachelor Student Working in parallel	21.07.22, Computer + Paper Test 12.10.22, Reflexion of the results and interpretation
16	48	Male, German	Professor	25.06.22, Computer + Paper Test
17	43	Male, German	Manager	25.06.22, Computer + Paper Test 26.06.22 Reflexion of the results and interpretation
18	25	Female, German	Master Student	25.06.22, Computer + Paper Test
19	41	Female, German	Scientific Employee	25.06.22, Computer + Paper Test 19.09.22, Reflexion of the results and interpretation

Table 3c

CMAC 0.2 Test Persons

No.	Age	Gender, Ethnic	Personal Background	Date and Type of Interaction
110	24	Female, German	Bachelor Student	06.10.22 Computer + Paper Test 12.10.22, Reflexion of the survey setup and content
111	24	Female, German	Bachelor Student	22.06.22 Computer + Paper Test 07.07.22, Reflexion of the survey setup and content

Table 3d

CMAC 0.3 Test Persons

No.	Age	Gender, Ethnic	Personal Background	Date and Type of Interaction
I12	15	Female, German-Dutch	Adolescent	22.06.22 Computer Test 07.07.22, Reflexion of the results and interpretation
I13	13	Male, German	Adolescent	12.09.22 Computer Test
I14	13	Male, German	Adolescent	12.09.22 Computer Test 13.10.22 Reflexion of the results and interpretation together with the parents
I15	17	Male, German-French	Adolescent	12.09.22 Computer Test
I16	15	Male, German	Adolescent	12.09.22 Computer Test
I17	16	Male, German	Adolescent	12.09.22 Computer Test 03.11.22 Reflexion of the results and interpretation together with the parents

Analysis

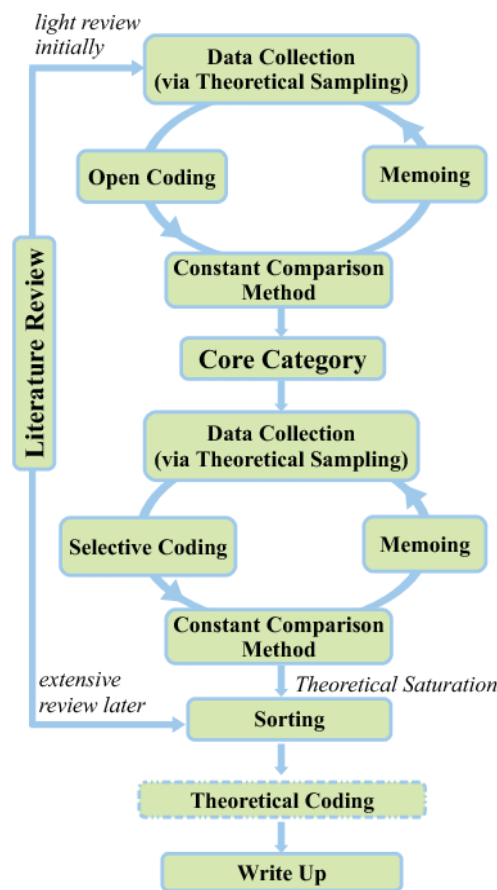
The analysis of the narrative interviews was carried out using the Grounded Theory.

Grounded Theory is an inductive methodology. Although many call Grounded Theory a qualitative method, it is not. It is a general method. It is the systematic generation of theory from systematic research. It is a set of rigorous research procedures leading to the emergence of conceptual categories. Grounded Theory can be used with either qualitative or quantitative data. (Grounded Theory Institute, 2013; cited in Cho & Lee, 2014, p. 2)

The Grounded Theory methodology follows a standardized approach (see Figure 2) and combines open, axial, and selective coding (see Figure 3). The Grounded Theory approach starts with the data collection in which the constant comparison of open codes (begin of questioning, reflecting, and categorizing actions) and memos (documentation of dealing with data) lead to core categories. Core categories are held against contradicting cases, relating theories, and perspectives (axial coding). Additional data collection builds the foundation for the final stage of coding in which the core concepts are documented and their sub categories as well as categories (selective coding).

Figure 2

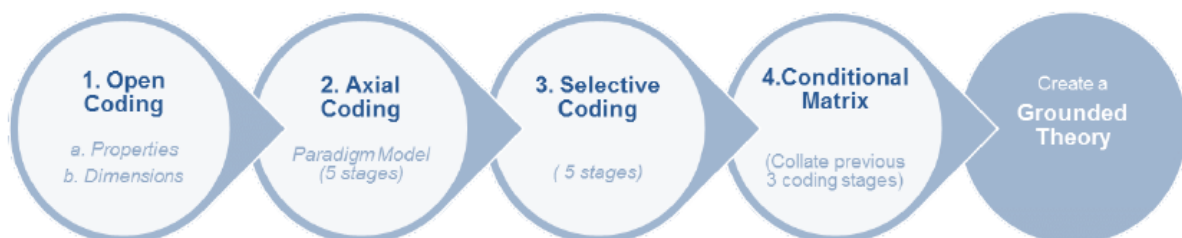
Grounded Theory Approach



Source: Hoda et al., 2010, p. 1

Figure 3

Grounded Theory Coding Process



Source: Strauss & Corbin, 1990; cited in Kenny & Fourie, 2015, p. 1275

This paper should be seen as a first insight into an ongoing Grounded Theory analysis that is still in its infancy.

Results

The data collected within the online survey was analyzed empirically and descriptively. The results do not form the basis of this contribution and are therefore not presented. Only those findings that are relevant for the application and evaluation of the online survey or its structure are reflected. The derived results focus on the analysis of the adult interviews, as there are profound conversations and further reflections here. The aim is to understand the challenges of HGSP and to work out systemic environment parameters in the German Education System. Afterwards, the structure of the questionnaire and the adjustments made to its structure and contents will be discussed. As the test is still in development, the sample needs to be more significant to reflect stable results.

Meta-Level Insights from the Narrative Interviews with References to Direct Statements

The findings from the interviews are clustered according to the study objectives.

1. The support of HGSP is an important societal need that can clearly create benefits to the highly gifted ones but also to the society. All HGSP were characterized by quick comprehension, intense metacognition, and an extreme willingness to solve complex contexts on their responsibility. In addition, there was a meaningful openness or curiosity for new topics and the desire to learn new things constantly. If HGSP are enthusiastic about a topic, the intrinsic motivation is activated, and an enjoyment of the activity happens. HGSP can explain complex contexts easily and thus amaze those around them. The characteristics described are mainly required in exploratory activities, which can also lead to the further development of a society.

2. Adequate support should be focused on and value the characteristics of gifted people.

Highly gifted people grasp more quickly than others and, therefore, experience exclusion, and strengthening self-love is of particular importance to them.

For example, I2 said: "My direct colleague often approaches me with logical problems. Now, I can solve it very quickly. In the past, I always felt that my colleague thought I could not answer so quickly and got on my nerves. Sometimes my colleague was also angry that my solution came so quickly. Today, quick answers and solutions are accepted. Moreover, I always thought it would take longer and be very complicated. I do not think that anymore. Moreover, I don't do it that way either." I2 also said: "My boss yelled at me when I did my first term paper. He accused me of not doing my work. That also happened to me with the architectural model in the seventh grade. Then I am accused in a normal tone of not having done the work myself. It happened to me more than once."

I3 said: "And then in my studies, I always had this black-and-white view. Either you failed ultimately, or you passed with a 1. But that you could give with a 3, so to speak, was part of my worldview. And then there were these three languages - Hebrew, Hebrew, and Latin - which I had to learn because I hadn't known them before. I had French, English, and Spanish before. And then I was genuinely excited before the exam. And I thought, man, I hope I can do it. I hope I pass. And then one of my fellow students went berserk and said, "Oh, I'm just

flirting, and I should save it, and I'd get another A anyway. And I should keep my mouth shut. And I was tough to take and all that. She thought I was playing at it somehow or fishing for compliments. But that wasn't the case at all - not at all. And I was so perplexed that I still remember exactly how she reacted. Because for me, it was a genuine fear of failing and a possibility. And she didn't see it that way or perceive it differently, and then she was also correct."

I1 said: "At the end of the lesson, within 5 minutes at the most, I have written down the homework, and then my notebook circulates through the class, and everyone wants to copy from me."; I1 also said: "But the role was already clear. The others do not know, and I say it. Alternatively, later at school, there was a situation where the teacher asked all the possible pupils, and they didn't know, and when I stretched, the teacher said - yes, we know that you know that anyway."

The sensory perceptions of HGSP are extremely active. Techniques to focus or the expression of emotions are needed.

For example, I2 said, "I have excellent hearing. Not all the time, but when I am relaxed. I can hear very far away in the office when something is being said. So that I can hear and compare it with a colleague who had the conversation."

I1 said: "Sounds, smells, and substances can get on my nerves."

I3 said about her child: "[...] if you notice that your child is somehow delicate and perhaps a little different, more cautious, shyer, or with special idiosyncrasies. Then by no means devalue him or, her but accept and somehow appreciate what is there. For example, my child does not like that sound when you run your hand, especially your fingernails, over plastic clothes like jackets. My child freaks out and is also so sensitive at the sight of people. My child threw up once while watching another child eating."

HGSP have conflicts with people in power since there is no trust in authorities. HGSP must learn to choose battles skillfully and to distinguish between necessary changes and perseverance.

For example, I3 said: "My headmaster also wants to expel me at the end of the school year. [...] It was announced at a conference that I would leave at the end of the year, but I did not know that beforehand."

I1 said: "The challenge was always the hospital hierarchy. It was always the problem with the chief physicians. So, this constellation is not just my privilege. I get on very well with the patients but not with the hierarchy." The person also said: "I remember how shocking it was, I think in the third grade when I realized for the first time that what the teacher was telling us was wrong. A world of trust collapsed for me."

HGSP tend to want to help others and therefore have to stop themselves from helping without being asked or from harming themselves. HGSP must be consciously careful not to stray and let others distract them from their passions.

For example, I1 said, "Actually, I feel responsible for curing diseases. But it seems to be common among patients to ask me about everything. Not only patients, but also friends and recently my parents. Recently I got the hint that I was thinking of the Dalai Lama's title - Ocean of Wisdom. It wasn't exactly the keyword. But that I am a wise person who can be asked about everything, and I have not only factual knowledge about everything, but often a very idiosyncratic point of view. So, on most things, I don't just know - well, the next way to go is just that, why don't you do that, that's how you do it - but that the answer can come back that the whole way is actually misguided. Why don't you do it completely differently? Think about whether you need it at all. It's much better without it. I can also show you how to do it better. And that exists in many areas of life. I am asked about many things - how can one live well? How can you cope with difficult situations? How can you see things completely differently?"

I2 said: "I also often fall into giving the other person a lot of space. I still have this syndrome of wanting to help or heal or understand. So, I also like to do that and offer it."

I3 said: "Because I always think that if I can somehow contribute to gaining knowledge and even help other people, then I like to do that."

3. There is a strong demand for further research in that field, especially on HGSP who did not get sufficient support in their youth.

All three interview partners clearly articulated that their daily life during childhood, youth and adulthood was characterized by a series of challenges related to their high giftedness. This ranged from general bullying to denying their creatorship (e.g. by teachers) when specific tasks were conducted. HGSP clearly articulated a desire for stronger support during their school and early university or job time. HGSP report on their challenges in day-to-day interactions with their fellow-human-beings and the support required to translate the existing world to them.

For example, I1 said: "So I think it is crazy in hindsight that when I was at school in my later school years, I had no guidance whatsoever about what was important in life. What subjects I could take. Also, what I could study. That is just one point out of many. I do not think I had any support or guidance at all. Furthermore, I could have used it."

I3 said: "So, when I was eleven or twelve, my father completely disappeared from my life. And from then on, I was completely responsible for myself and the support of my mother. Well, and then I kind of tried to get my life together. Well, and I think it was just noticeable that I could never really make friends, because the topics of the others were never really my topics. Well, and I think that was always my childhood theme - looking for a reason to exist. "

The following Table 4 aggregates the insights on the Pains, Gains, and Solutions that were mentioned by HGSP in the narrative interviews.

Table 4

HGSP Pains, Gains and Solutions [excerpt]

Pains	Gains	Solutions
Incomprehension	Understanding	Find Like-Minded People Mindful Communication Storytelling
Injustice	Transparency, Support	Standing up for Oneself Self-Acceptance/Self-Love Conflict Management
Devaluation	Self-Protection	Standing up for Oneself Self-Acceptance/Self-Love Conflict Management
Exclusion	Individual Allies	Small Talk Finding Interest Groups
Underchallenge	Seeking Personal Challenges	Living the own Speed Find Like-Minded People Visit Formats for the Gifted Follow Individual Interests Read Books Find Learning Contexts supporting the Gifted
Degradation	Self-Protection	Standing up for Oneself Self-Care Coaching Conflict Management
Manipulation	Self-Explanation	Clarify own Needs Follow own Interests Storytelling Coaching
Exploitation	Self-Explanation	Clarify own Needs Follow own Interests Prioritization Coaching
Unjustified Accusations	Self-Protection	Fixing Own Priorities Standing up for Oneself Self-Care
Be left alone	Guidance	Mentoring Programs Interest Groups Communities for the Gifted

Explanation of the Test Structure and its Adaptations

In the introduction, it was already explained that the promotion of giftedness focuses on the cognition of people and its promotion. Our age, which is shaken by climate, health, education, and social crises, makes it clear that people's existing competencies are not sufficient to meet the complex challenges. Holistic approaches are required that focus on people's creativity, motivation, and cognition as well as self-regulation and meta-cognition abilities. Existing tests focus on either one or the other and are very time-consuming and resource intensive. As well, not every person is tested for giftedness or sensitivity in their life. Often these are only done when teachers or parents have an eye for it. And that is probably more rarely than often the case. Recognizing whether a person is gifted or highly sensitive is difficult even for trained staff, as misdiagnosis can occur (see Webb et al. 2020). Or tests are conducted, and no support measures follow from the findings. The latter is most often the case. For these reasons, the authors search for a solution enabling education systems to roughly pre-evaluate the status quo of existing cohorts. A simple and quick procedure seems to be useful, which can be used as a filter for further support and test procedures. In this report, the first attempts were made to map such a standardized procedure via an online platform (LimeSurvey). The test was composed based on diverse criteria - be less than one hour long, varied, self-explanatory, instructive, and thus entertaining, so that many learners can be activated.

Study respondents feedbacked joy about the findings generated through the online survey. Versions 0.1 and 0.2 of the CMAC test struggled with faulty analysis tools. While the evaluation of some creative tasks became a challenge, there were problems with the scoring logic of the IQ-test. In particular, the creative tasks received special attention from all participants, as there was great curiosity about how these are collected and evaluated. Also, the confrontation with one's emotions and how to deal with them, particularly about high sensitivity, caused uncertainties in reflection and handling. This can signal the educational work demanded by all highly gifted adults in the in-depth interviews.

Even though the CMAC 0.3 received very positive feedback from the adolescents and their parents, there is still room for improvement. For example, the findings from the learning type determinations were not meaningful and were therefore not discussed with the test takers in the reflection. The self-developed entry test on giftedness types elicited very high agreement. For a few statements, the parents of the adolescents had a different perception, which is why dealing with the result and discussing it is essential for gaining knowledge. However, only half of the participants signed up for a reflection. Platform-based feedback could trigger a higher response, as no appointments must be coordinated, the participants can control the time required, and the results can be reflected without personal contact.

For the future, it is essential to find a way to better understand performance motivation and cognitive performance. To this end, further tests are to be identified and tested. A computer-based standardized evaluation procedure of the creativity tests would be desirable for the foundation of the analysis, as well as testing of the cognitive performance in a playful way. It is also a good idea to put the demographics at the end of the questionnaire so that subjects are not biased positively or negatively.

The facial action coding software gives rough signals about which tasks lead to disinterest or interest in the subjects. For this reason, the online test is supplemented with interrogations of

emotions based on Russell's (1980) valence and arousal model. None of the subjects contradicts the findings. On the contrary, HGSP and their parents report that the findings hold new insights for them. The regulation and awareness of one's own feelings became part of all discussions with parents and young people. The ability to think about one's own behavior (meta-cognition) varied greatly among the young people.

Discussion of the Results

Implications for dealing with Highly Gifted Students in the German Education System

I12 has a certified IQ greater than 135 and was one of the most diverse gifted person in the experiment at the school in Berlin Zehlendorf. The test person has severe problems in school and private environments. The adolescent states that she is interested, passionate, enthusiastic, and involved in teaching matters when this is interesting and not boring. Her teachers argue that she is physically and/or mentally absent most of the time. Most of the teaching matters seem to be uninteresting for the tested and interviewed adolescent. Although very high cognitive skills and creative potential are demonstrated, these cannot be activated with existing learning situations. Her talents are thus unused and not valued. She is portrayed as uneducable and the reason for this seems to be inappropriate learning situations.

Strengths and Weaknesses of the CMAC Test

The battery of questions of the Giftedness Types and High Sensitivity in a self-report works as the results agreed with the children themselves, teachers in the "Initiative für Hochbegabung" [Initiative for the Highly Gifted], and parents. This could be an indication of its validity. The reliability of the CMAC 0.4 still needs to be tested. Larger samples are to be set up for this purpose in the future.

The OMT gives exciting insights into implicit social motives, but this only corresponds to one hundred percent to the achievement motive, which is why the achievement motivation test should be the focus of future test scenarios. One option to test the motivation for achievement might be the LMI – "Leistungsmotivationstest" [Performance Motivation Test] (Schuler et al., 2001).

The creative potential of the test persons can be assessed well with the three tasks described and their adaptation to adults. Jury evaluations with the TTCT are challenging because the feedback varies widely. This problem is well known in the scientific community, which is why researchers are investigating whether ratings by machines might be a better solution (cf. Kovalkov et al., 2021). The present study will be supplemented by experiments that also examine mentoring situations in learning situations (cf. Kim, 2016). These will focus on the formation of metacognition and self-regulation (cf. Kuhl, 2004).

The test results should serve as a basis for further observations throughout the year and be supplemented with experiments in learning situations (cf. Renzulli, 1999). Reflecting on the present understanding, it is conceivable that the 1-hour-CMAC can serve as a filter to identify those students with whom further creative and cognitive tests as well as experiments should be conducted.

Conclusion & Outlook

Is the 1-hour CMAC suitable for identifying diverse potentials or talents? From today's point of view, an online test is suitable to identify the performance-motivated and creative gifted. Certainly, a preselection already takes place through the freedom to decide whether to participate in the test. A statement about the reliability of the test cannot be made now. For this, further surveys of large samples in diverse contexts are necessary.

Can the findings be used to develop study formats? The online test alone indicates creative and cognitive potential as well as its application in exercises. It says nothing about how motivated and effective students are to perform during the semester and what effect social group processes have. For this reason, it is recommended to set-up test scenarios throughout the semester and to document and evaluate them in a sustainable way in different courses and at different institutions.

Should a rethink and restructuring of the German Education System be sought based on the study findings? The critical reflection of the perceptions and experiences of HGSP suggests that the conditions in state schools and universities should be addressed. In particular, the reviews with adolescents and their parents showed that teachers in the existing system could not engage with the needs of the minority. High performance, critical questioning, and high ethical standards are not valued. On the contrary, rejection and exclusion are perceptible. One of the survey's most robust and versatile adolescents is currently being banned from school. Educators have narrow time frames and serve the state to follow their targets. Often there is no room for individual task formats adapted to personal preferences or creativity as well as interest-based learning. The question of whether appreciation can be a gateway to meeting eye-level needs to be examined. The orientation of higher education and school systems towards customer- and employee-orientation could be an approach.

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Attachments

- A. Interview Guide for HGSP
- B. CMAC 0.4

A. Interview Guide for HGSP

- 1) Tell us what positive or negative experiences you have had along your life and what you attribute to your high giftedness and high sensitivity.
- 2) Questions focusing on the Term List below (...)
 - What does ... mean to you?
 - Where have you ... experienced?
 - How did ... expressed itself?
 - What does ... help/hinder you with?
 - How does your environment react to ...?

Term List:

- Sensitivity
- Self-confidence
- Argumentation skills
- Adaptability
- Associative ability
- Well-being
- Performance
- Creativity
- Conscientiousness

- 3) Do you sometimes look at your life / yourself from the side? If so, do you sometimes ask yourself "what am I actually doing here"? What do you see? What does it mean to you?
- 4) When you talk to friends / family, do you more often or sometimes take the role of a spectator? How do the others feel about this? What does this mean for you?
- 5) What questions do friends or colleagues ask you? Why do you do this? Do you value certain attitudes/qualities in yourself?
- 6) Do you like to discuss with others? What do you like about it? What do you dislike about it?

B. CMAC 0.4

- Self-Report on Fields of Giftedness and High Sensitivity:
 - 8 Questions on Intellectual Giftedness
 - 8 Questions on Imaginary Giftedness
 - 8 Questions on Emotional Giftedness
 - 8 Questions on Psychomotoric Giftedness
 - 8 Questions on Sensoric Giftedness
 - 8 Questions on High Sensitivity
- Emotional State Query
- Creative Potential & Application Test:
 - Creative Application Task
 - Verbal Creativity Task
 - Creative Potential Task
 - Problem Solving Task
- Emotional State Query
- Motivation for Achievement Test
 - The following three questions are posed to each of five ambiguous images:
 - What is important to the main character?
 - What does the main character do?
 - How does the main character feel?
- Emotional State Query
- Cognitive Capacity Picture Puzzle
 - Twelve Picture Puzzles
- Emotional State Query
- Personality
 - Extraversion
 - Compatibility
 - Conscientiousness
 - Neuroticism
 - Openness for new things
- Emotional State Query
- Demographics