Meeting the learning and developmental needs of gifted individuals

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Gifted and creative children in school

- 1900 Ellen Key: *The Century of the Child*
- 1916 Peter Petersen: *The Rise of the Gifted*

William Stern stated in his article in this book:

(1) giftedness represents only the possibility for achievement; it is not the achievement itself.

(2) acceleration and enrichment programs are needed in the elementary schools not just for the top 2% of the top gifted children but also for another 10% of the top children as well.

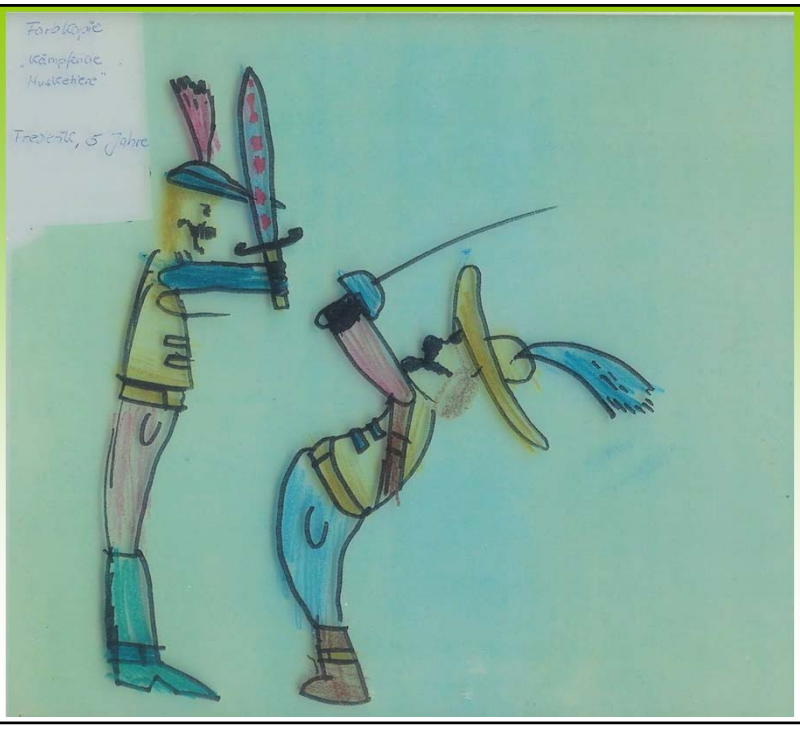
In Germany each year 70,000 to 80,000 are born who are gifted up to very gifted. Curriculum is however made for the average. What do we do with slow learners and what with fast learners?

Gifted and creative children in school

Curriculum Conceptions, Purposes of Education and Content Sources

Curriculum Conception	Purpose of Education	Primary Source of Content
Cumulative tradition of organized knowledge	To cultivate cognitive achievement and the intellect	Academic disciplines, subject matter
Social relevance-reconstruction	To prepare people for living in an unstable, changing world; to reform society	Needs of society and culture
Self-actualization	To develop individuals to their fullest potentials	Needs and interests of learners

Table 1. Curriculum Conceptions, Purposes of Education, and Content Sources (E.J. Sowell, 1996, p. 41).



The emerging conceptual framework

• Terman (1877-1956) longitudinal study since 1921 with 1528 individuals. Only IQ one factor theory, no creativity.

• Not included William B. Shockley and Luis W. S. Alvarez who received the nobel prize in 1956 and 1968 in physics.

• Most creative are not included when identification is only focused on intelligence.

• Getzels & Jackson (1962): *Creativity and Intelligence*. Main outcome: divergent or productive thinking can not be detected with an intelligence test.

• Renzulli (1978): *What Makes Giftedness? Re-Examining a Definition*

• Three-Ring-Conception: above average ability, task commitment and creativity.

• Most current definitions of giftedness include creativity.

• Giftedness is an individual potential for good or outstanding achievements in one or more areas.

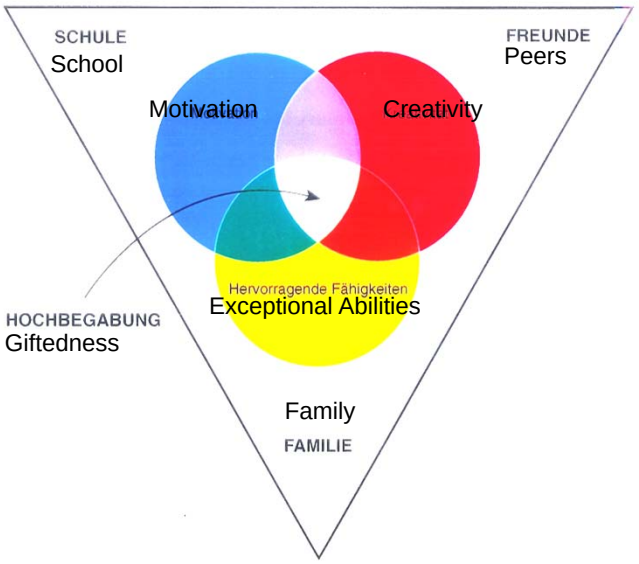


Abb. 1: Mehr-Faktoren-Modell der Hochbegabung (Mönks, 1985)

Multi-factor model of giftedness (Mönks, 1985)

The emerging conceptual framework

Heller gave the most comprehensive description of giftedness

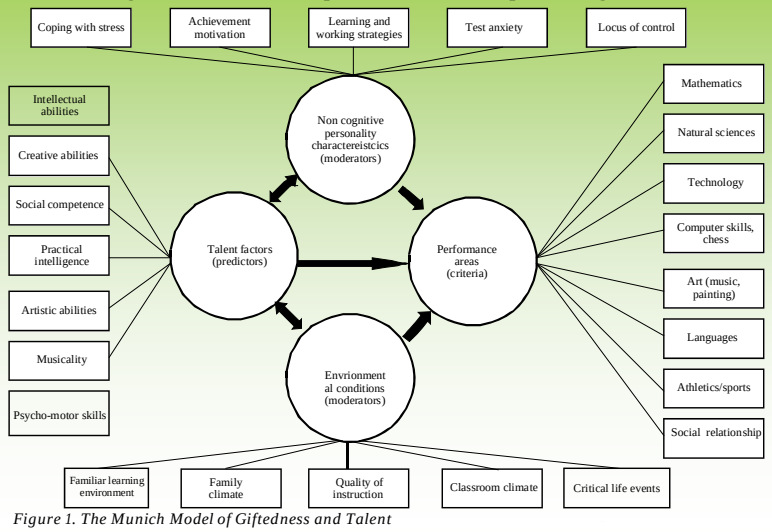


Figure 1. The Munich Model of Giftedness and Talent

The emerging conceptual framework

- Cropley & Urban (2000) concluded that "a combination of intelligence and creativity defines giftedness", i.e. creativity and intelligence are integral elements of giftedness (p. 485).
- Creativity is always an expression of novelty. In other words, "creativity is the production of relevant and effective novel ideas" (Cropley & Urban, 2000, p. 486).
- For Gardner there's a direct relationship between intelligence and creativity. (*Frames of Mind*, 1983; *Creating Minds*, 1993)

The emerging conceptual framework

(1) linguistic	T.S. Eliot
(2) logical-mathematical	Albert Einstein
(3) spatial	Pablo Picasso
(4) musical	Igor Strawinsky
(5) bodily-kinesthetic	Martha Graham
(6) intra-personal	Sigmund Freud
(7) inter-personal	Mahatma Gandhi
(8) naturalistic	Charles Darwin

The emerging conceptual framework

- Renzulli & Reiss (2000) made useful distinction between *Schoolhouse* and *Creative-Productive Giftedness.*
- *Schoolhouse* giftedness is related to test-taking and lesson-learning abilities.
- Persons with *creative-productive giftedness* are not so easy to identify with standardized tests. They like to be challenged and they are productive rather than reproductive thinkers. Their attitude towards learning is also different from that of the Schoolhouse persons. They prefer deductive learning, "structured training in the development of thinking processes, and the acquisition, storage, and retrieval of information" (Renzulli & Reis, 2000, p. 370). Creative-productive giftedness is an expression of affinity to problem-finding and problem-solving. In effect, it is an autonomous learning style, and personal relevance of the subject matter to the student is important.

How to foster creativity in schoolchildren

Teachers who foster creativity in children demonstrate the following behavior characteristics:

- encourage students to learn independently
- encourage flexible thinking
- have a cooperative and adaptive style of teaching
- realize differentiated curriculum and instruction
- delay judgement of students' ideas and propositions
- tolerate 'sensible' errors
- stimulate self-evaluation and help to cope with frustration
- take questions seriously
- accepts alternative suggestions and solutions
- reward courage as much as being right
- protect creative students from conformity pressure
- show facilitative instead of rigid instructor behavior (see Cropley & Urban, 2000, p. 488).

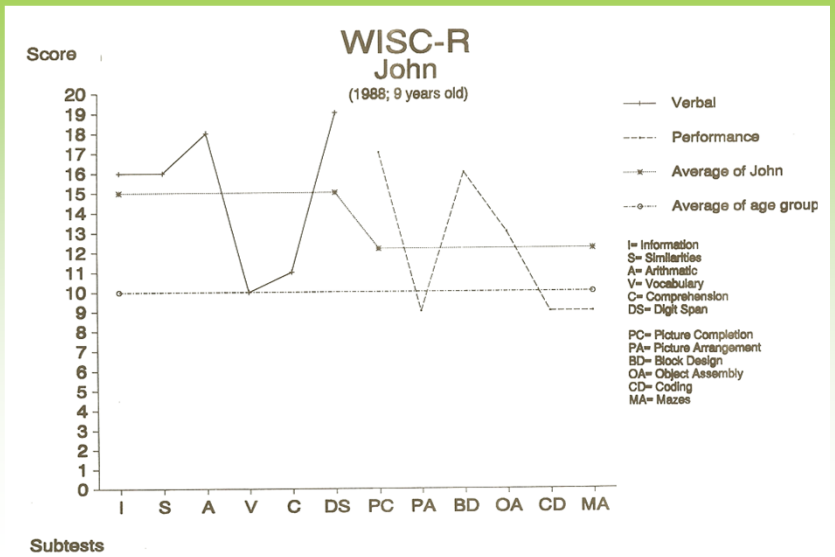
How to foster creativity in schoolchildren

Teachers, who manifest some or all of these behaviors should be able to foster creativity in children. Fostering creativity in children requires the encouragement of:

- openness to new ideas and experience
- adventurousness
- autonomy
- ego strength
- positive self-evaluation and self-concept
- preference for unusual solutions and for complexity
- tolerance for ambiguity
- ability to take risks into account (tolerance for risks)
- challenging and new learning and thinking skills (see Cropley & Urban, 2000, p.487).

How to foster creativity in schoolchildren

The development of the gifted and creative boy John.



How to foster creativity in schoolchildren

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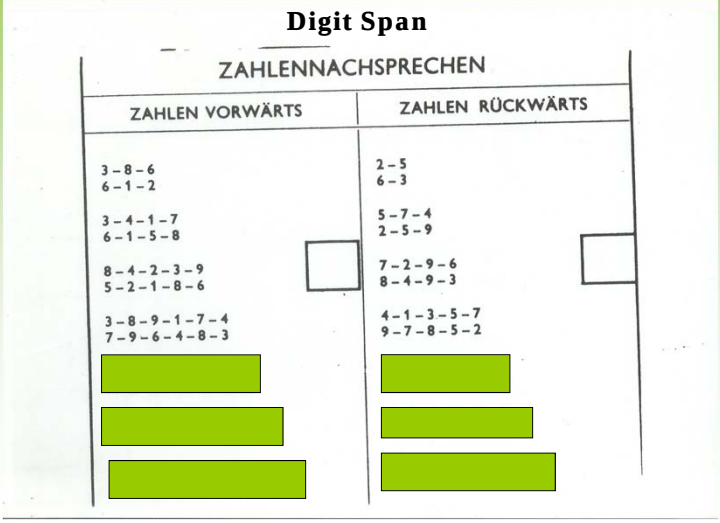

How to foster creativity in schoolchildren

The most ideal situation for invidual development is an interrelation between intrinsic motivation, skillful behavior, giftedness and creativity. It can be illustrated with a case history of the nine year John.

A polynomial with Galois group $\mathrm{SL}_2(\mathbb{F}_{16})$

Johan Bosman *

Abstract

In this paper we show an explicit polynomial having Galois group $\mathrm{SL}_2(\mathbb{F}_{16})$, filling in a gap in both the tables of Jürgen Klüners and Gunter Malle and the tables of John Jones and David Roberts. The computation of this polynomial uses modular forms and their Galois representations.

1 Introduction

It is a computational challenge to construct polynomials with a prescribed Galois group, see [13] for methods and examples. Here, by the Galois group of a polynomial $f \in \mathbb{Q}[x]$ we mean the Galois group of a splitting field of f over $\mathbb{Q}$ together with its natural action on the roots of f in this splitting field. Jürgen Klüners informed me about an interesting group for which a polynomial had not been found yet, namely $\mathrm{SL}_2(\mathbb{F}_{16})$ with its natural action on $\mathbb{P}^1(\mathbb{F}_{16})$. This action is faithful because of $\mathrm{char}(\mathbb{F}_{16}) = 2$. It must be noted that the existence of such a polynomial was already known to Mestre (unpublished). In this paper we will give an explicit example.

Proposition 1. *The polynomial*

$$P(x) := x^{17} - 5x^{16} + 12x^{15} - 28x^{14} + 72x^{13} - 132x^{12} + 116x^{11} - 74x^9 + 90x^8 - 28x^7 - 12x^6 + 24x^5 - 12x^4 - 4x^3 - 3x - 1 \in \mathbb{Q}[x]$$

has Galois group isomorphic to $\mathrm{SL}_2(\mathbb{F}_{16})$ *with its natural action on* $\mathbb{P}^1(\mathbb{F}_{16})$.

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Galois theory

Motivating examples

The quadratic polynomial

$$ax^2 + bx + c$$

has zeroes

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

and (Cardano, 1545, stolen from Tartaglia) the cubic

$$ax^3 + bx^2 + cx + d$$

has zeroes

$$x = \sqrt[3]{C + \sqrt{D}} + \sqrt[3]{C - \sqrt{D}} - \frac{b}{3a}$$

where

$$C = \frac{-b^3}{27a^3} + \frac{bc}{6a^2} - \frac{d}{2a}$$

and

$$D = C^2 + \left(\frac{c}{3a} - \frac{b^2}{9a^2}\right)^3.$$

How to foster high potential in schoolchildren

We can conclude that John's intrinsic motivation for the field of figures and math was manifest in elementary school. Unfortunately, the school was not able or not willing to meet his special gifts. On the contrary, the school staff was even happy when he left the school as we advised. To use this healthy part of his personality is - not only for him, but for all gifted/creative children - *the essential* treatment. Only then can they develop in accordance with their potential.