Shortcomings of the IQ-based construct of Underachievement

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Abstract

Despite being plagued by serious conceptual problems, underachievement ranks among the most popular constructs in research on the gifted. Many of its problems have their roots in the use of the IQ as the supposedly best method of measuring ability levels. Only a few decades ago the opinion was still widespread that the IQ-based construct of underachievement, having withstood neither its empirical nor its theoretical test, ought to be abandoned (e.g., Anastasi, 1976). Since then, some points of criticism have simply been forgotten. In this manuscript we would therefore like to take up and follow a few of the broken threads within the discussion. To this end, we present a thorough analysis of the implications of the IQ-based underachievement concept. First we present a definition of underachievement and give a brief overview of the history of the construct. We then enumerate the theoretical, methodological, and empirical problems of the IQ-based construct.

Keywords: Underachievement, Gifted Students, Theoretical Review, Identification, Classical Test Theory, Intelligence

1. Definition

Underachievement had been defined, often with reference to Conklin (1940), Shaw and McCuen (1960), and Durr (1964), as a *significant* discrepancy between a high level of giftedness and a relatively low level of achievement. Yet, as the influential work of Ralph, Goldberg, and Passow (1966) indicates, the concrete operationalization remained quite arbitrary. Their study offered good reasons for no longer considering the (maximum) individual achievement potential of a person, but rather the relative achievement potential in relation to a suitable reference group.

None of the operational definitions suggested in ensuing years has gained widespread acceptance. Shaw (1964), for example, recommended classifying gifted students as underachievers when their intellectual abilities (IQ) were in the upper 25% of their class and their school achievements remained under the class average. Hanses and Rost (1998) defined gifted underachievers on the other hand as schoolchildren with an IQ percentile of at least 96, but with a simultaneous percentile in achievement of 50 at most. In many other studies (e.g., Stoeger & Ziegler, 2005; Ziegler & Stoeger, 2004) a difference of one standard deviation was chosen. Of course, these cut-off points are all arbitrary. The operationalizations show various common disadvantages (as becomes clear below). For example, they are all based on the premise that a pupil's IQ gives a good estimate of giftedness, which, however, has not been sufficiently demonstrated. Following Ziegler (2008a, p. 18), we thus propose a definition that avoids deciding too hastily on a specific giftedness model such as IQ and conserves the essential content of the construct. Researchers do in fact agree that underachievers perform at a level below that of their actual performance potential (e.g., Berkowitz & Cicchelli, 2004; Chukwu-etu, 2009; Delisle & Berger, 1990; Fletcher, 2005; Hoover-Schultz, 2005; Kim, 2008; Khan, 2005; Montgomery, 2009; Reis & McCoach, 2000; Rimm, 2008; Smith, 2005). It is with regard to their conceptions of giftedness, however, that they take different approaches to estimating performance potential. Thus a definition is required which can hold

for approaches as different as Heller's and Perleth's Munich Model of Giftedness (Heller, Perleth, & Lim, 2005), that of the Columbus Group (Columbus Group, 1991), and Ziegler's Actiotope Model of Giftedness (Ziegler, 2005). We therefore prefer a so-called delphic definition which conceptualizes underachievement not as a real quality of a person but as a theoretically grounded attribution.

Definition:

Underachievers are talented persons whose current achievement is below experts' expectations. Without intervention, this will result in unfavorable prognoses for the achievement of excellence.

2 The history of underachievement research

The study of the phenomenon of underachievement can be divided into three quite distinct phases: an early *pioneering phase*, a conceptually fruitful and empirically rich *critical phase*, and a *social phase*, reaching into the present, which is characterized by stagnation and a dearth of theoretical reflexivity.

2.1 The *pioneering phase* (until 1950)

Early giftedness research is characterized by its pioneer investigators' optimistic expectations that giftedness, which was seen as the equivalent of high intelligence, was also the basis for excellent levels of achievement. The first longitudinal studies showed, however, that this expectation needed to be thoroughly revised (e.g., Hollingworth, 1942; Terman, 1947; Terman & Odon, 1959). Although highly intelligent persons exhibited above-average occupational and academic success as a rule, a substantial portion of this group lagged behind expectations. Therefore, underachievers were at first defined as such persons who, relative to their excellent IQ-test results, remained unexceptional both occupationally and in other areas of life. While the intelligence quotient became established as a giftedness indicator, concrete

achievement characteristics and, particularly, the discrepancies between giftedness and achievement attracted little critical attention.

2.2 The *critical phase* (1950–1970)

Terman's and Hollingworth's results met with strong criticism. The term "gifted underachiever" seemed to be an oxymoron, since, according to the dominant view, "gifted" persons were supposed to be predestined for higher achievement levels. The concept of "gifted underachievers" seemed to be an impossibility. This led to numerous empirical studies based on numerous operationalizations of four groups of persons: (1) gifted achievers, (2) gifted non-achievers, (3) normal achievers, and (4) normal non-achievers (e.g., Gowan, 1957; Kimball, 1953; Kurtz & Swenson, 1951; Morgan, 1952; Passow & Goldberg, 1958; Rust & Ryan, 1953). The results pointed to clear differences between gifted achievers and gifted non-achievers. But it was also shown that gifted non-achievers were much more similar to average pupils than to the gifted ones. This strengthened considerably the doubts about the meaningfulness of the underachievement construct and the effectiveness of the IQ as an appraiser of giftedness. In her much-praised review, Anastasi (1976) systematized the empirical, theoretical, and methodological points of criticism that had meanwhile accumulated around the issue. In particular, she concluded that the comparison of IQ and achievement-test results was, in most cases, not meaningful, since such comparisons reflected a measuring error.

Other authors looking back on the critical phase have stressed that the inflation of theoretically unjustified definitions of underachievement had contributed more to confusion than to enlightenment (Dowdall & Colangelo, 1982; Whitmore, 1980). In their literature review, Dowdall and Colangelo (1982) come to the conclusion that "the variability of definitions is of a magnitude that makes the concept of the underachieving gifted almost meaningless" (p. 179). Particularly confusing is the aforementioned finding that, regardless of which definition one chooses, gifted underachievers were much more similar to pupils with

average-level gifts than they were to gifted achievers (Anastasi, 1976). This suggested not considering the phenomenon of underachievement to be a genuine object of giftedness research at all and leaving its examination up to pedagogical psychology or pedagogy.

2.3 The *social phase* (1970–)

Today's view of underachievement has been strongly shaped by societal developments in the USA and the ways in which the social sciences have reacted to them. The "Sputnik shock" led to a much stronger awareness of the significance of education and also to a significant increase in support for the gifted. The American public believed the gifted could help their country regain worldwide leadership in science and technology. But reaching this goal seemed to require the contributions of *all* gifted individuals (Tannenbaum, 1983). In this educational policy climate, the first systematic study of underachievement met with great interest. It was conducted by Whitmore between 1965 and 1970 in California (e.g., Whitmore, 1980).

One of the main findings of the Whitmore study was that the usual methods for preventing underachievement in gifted students were often insufficient. This observation stimulated multiple research efforts, but these were hampered by an interest in quick gains in knowledge which in turn discouraged interest in the considerations of the previous critical phase. The view rapidly began to prevail that underachievement could be "cured" (Jackson, Cleveland, & Merenda, 1975; Perkins & Wicas, 1971; Zilli, 1971; Ziv, Rimon, & Doni, 1977). Schultz (2002) has called this view in retrospect the "shift to social concerns".

Richert, Alvino, and McDonnel (1982) examined the practice of identifying the gifted in an influential national report, which showed that many gifted individuals remained unrecognized, in particular among the subgroup of the underachievers, who were thus, de facto, shut out of support programs. This launched a lively debate, at the center of which lay the accusation that the learning and developmental needs of underachievers were not being met. At that point, the question of the best forms of intervention became, and has remained,

perhaps the most important single question in giftedness research (Compton, 1982; Delisle, 1982). However, research efforts have concentrated mainly on identifying the *differences* between gifted achievers and gifted underachievers (e.g., McCoach & Siegle, 2001, 2003; Rimm, 1988; Schultz, 2002). It was unsatisfactory that in comparison to the previous critical phase, hardly any increase in knowledge was being made. Numerous researchers working during the 1960s advanced explanations for the observed differences between gifted achievers and gifted underachievers based on variables such as motivation, frustration and boredom, the home, learning environment, and various personality factors (Bachtold, 1969; Baymur & Patterson, 1960; Dunn, 1963; Durr & Collier, 1960; Gallagher & Rogge, 1966; McGillivray, 1964; Morrow & Wilson, 1961; Perkins, 1965; Ralph, Goldberg, & Passow, 1966; Shaw & Black, 1960; Shaw & McCuen, 1960). Up to now this list has been simply augmented with newer constructs such as perfectionism, ADHD, and epistemic beliefs (for an overview see Stoeger, 2008); and this fact illustrates that essential theoretical progress has not been made.

3. The renewed theoretical, methodological, and empirical discussion of the underachievement construct

In this unsatisfactory situation we see the necessity of reinitiating the discussion of the critical phase and of thoroughly re-evaluating the *construct of underachievement* from today's perspective. In this section we discuss the central theoretical, methodological, and empirical points which, in our opinion, require urgent clarification.

3.1 Scientific and theoretical critique

3.1.1 Lakatos's method of "monster-barring"

It is a commonplace notion in scientific thought that a theory will probably never exist which can make predictions in perfect harmony with the empirical data. Discrepancies between theoretical expectations and empirical findings are called anomalies in philosophy of science. Imre Lakatos (1977) formulated the well-known allegory of all our theories swimming in a sea of anomalies; and this image holds for empirical pedagogical and psychological research.

In the case of giftedness research, the monster-barring analogy is valid in the sense that error probabilities are calculated into significance tests from the start. In other words, researchers come to terms with anomalies by specifying a priori a tolerable amount of anomalies.

Anomalies do not necessarily undermine the usefulness of a theory. But it is imperative to observe transparent, rational rules in dealing with them. The greatest mistake is treating anomalies in such a way as to make the theory immune to all attempts to refute it, and unfortunately this is precisely what the current conceptualization of underachievement does.

Lakatos (1979) used the term "monster-barring" to describe the method of systematically excluding counterexamples which contradict a theory. At its core, such "monster-barring" seeks to prevent deficient theories from effecting undesired results. The equation of intelligence with giftedness led to an ocean of anomalies. Thus, particularly gross deviations from this theory – when, for example, gifted persons failed to produce high-level or even (above-)average achievements and instead showed unexpectedly low levels of achievement – were neutralized by the concept of underachievement. In fact, every underachiever clearly represents an anomaly for the identity hypothesis, according to which being highly gifted is identical with high intelligence. Each underachiever could be considered a falsification of the identity (giftedness = high intelligence) hypothesis. Instead, it was decided to employ underachievement as "monster-barring" and cultivate it as a separate field of research.

3.1.2 Reification

Reification refers to the inadmissible objectification of constructs, viewing them as if they really existed. Indeed the construct of underachievement consists of three constructs, namely intelligence, achievement, and the discrepancy concept. With an eye to reification, it follows that the construct of underachievement – assembled from these three constructs – cannot be investigated as a real entity or as a fixed attribute of its possessors (the "underachievers"). In fact the correct interpretation of the concept "underachiever" would mean a gifted person – in

the usual sense of gifted, namely, one who is highly intelligent – for whom the predictive model has failed.

This criticism is not an exaggerated quibbling which castigates those who have committed an offense of linguistic carelessness of no real consequence. We ought rather to accustom ourselves in future debates about underachievement and underachievers to always remembering that we are actually talking about our predictive model and that our research results serve its testing and not the research on a reified construct.

3.2 Methodological critique

Underachievement is usually conceptualized as a significant negative discrepancy between achievement in one area (such as academic success) and supposed potential (such as intelligence). As in every test situation, attempts at determining the number of underachievers will lead to measurement errors, because neither achievement nor potential can be determined without a margin of error (cf. Anastasi, 1976). The general opinion is that the errors are few enough to neglect. We want to show that, quite to the contrary, such errors have disastrous consequences, since they not only result in individuals being falsely classified, but also lead to the systematic overestimation of the number of underachievers.

For the rest of our paper we assume that potential (intelligence expressed in an IQ format) as well as the measurement value achievement are normally distributed. Usually IQ is scaled such that the measurements have an average of 100 and a standard deviation of 15 points. For the following calculations it is simpler to scale achievement (A) and potential (P) such that both are standard normally distributed, that is, exhibit an average of 0 and a standard deviation of 1. Because of the centrifugal effect, this means that the true values A and P have a lower standard deviation (depending on the exactitude of the measurement) (cf. Ziegler & Ziegler, 2009).

From among the many definitions of “underachievers” mentioned in the literature, we first consider the presumably most common one: The underachiever is a person whose

achievement remains more than one standard deviation behind her or his potential (Stoeger, 2008). Other definitions do not essentially vary the result and are sometimes cited. In the following section we show how measurement error in capturing potential and achievement affects the number of underachievers identified. We present these relations first for two cases in which (1) there are none or (2) only a few underachievers, and then look at the maximum number of underachievers – according to the underachievement definition chosen – that can be found in one sample of gifted students.

3.2.1 If there were no underachievers at all, then …

… a few would be found anyway because of the aforementioned measurement error. We assume that the potential (P) is identical with achievement (A) and that the measurement error for potential (E_P) and for achievement (E_L) are normally distributed with standard measurement error s_P and s_L respectively and without any systematic bias (i.e., their mean value is 0). It is a general property of independent normally distributed variables that the square of the standard deviation of their difference is the sum of the squares of their standard deviation. Thus the difference of both values is normally distributed with a standard deviation of $\sqrt{(s_P^2 + s_L^2)}$. For standard normally distributed values with reliability (R), the standard measurement error can be determined as $s = \sqrt{(1 - R)}$, since reliability (R) is the square root of the ratio between the standard deviation of the true value and the standard deviation of the measured value, so that the following chain of equations holds:

$$s^2 = \sigma_{measured}^2 - \sigma_{true}^2 = \sigma_{measured}^2 - R\ \sigma_{measured}^2 = (1 - R)\ \sigma_{measured}^2 = (1 - R).$$

Expressed in reliabilities, the standard deviation of the perceived discrepancy between potential and achievement is thus $\sqrt{(2 - R_L - R_P)}$. This prompts the question of how great the number of those is for whom this discrepancy value is greater than 1. This amount can be found in a standard normal distribution table by looking up the probability of a standard normally distributed variable being greater than $1 / \sqrt{(2 - R_L - R_P)}$. Typical scores on an IQ test with a reliability of 0.85 and school marks with a reliability of 0.55 would result

nonetheless a distortion of 9.85%. Thereby approximately 10% of the total (not only of the gifted!) students would be considered underachievers, even if underachievement was a non-existent phenomenon (cf. Table 1).

The figures naturally look different for alternative definitions of underachievement. If, for example, one defined underachievers as only those whose achievement is two standard deviations behind their potential, the previous example would result in only 0.5% of falsely identified underachievers. Of course this is still a dramatically high error proportion, since with such a strict criterion the portion of underachievers can only be very small anyway (see below). The relative error of the portion of falsely identified underachievers remains considerable in this case.

3.2.2 If there were some underachievers, then …

… their number would be markedly overestimated. The previous calculation assumed there were no underachievers and showed that on account of measurement errors a few were nevertheless "found". If one now assumes that underachievement is a "real" phenomenon, i.e., that achievement and potential are not the same, then the result is in an even greater share of non-underachievers compared with phantom underachievers who are falsely classified as underachievers. This arises because, through the measurement error, many persons who exhibit a slight discrepancy between potential and achievement are raised over the threshold of one standard deviation determined per definition. And although the reverse effect also occurs – underachievers who only barely fulfill the criterion are pushed under the threshold because of the measurement error – the latter effect is smaller, since there are more persons under the threshold than above it (cf. Ziegler & Ziegler, 2009).

3.2.3 How many underachievers can actually exist?

First, it is best to remember that underachievement in its current conceptualization is a relative concept that depends only on how a person's potential and achievement score in comparison to a reference group. For every achievement coefficient point more that a person has, another

person must have one less. Thus there is a fundamental symmetry of underachievers and overachievers which makes it impossible for underachievers to comprise more than 50% (even if the assumed distributions were not normal distributions but merely symmetric ones). But the boundaries are in fact considerably sharper.

Assuming that the potential value for the achievement concept has been chosen sensibly, one should presume that potential is at least not systematically detrimental to achievement, and in fact positive relationships between intelligence and achievement are typically found. Under plausible model assumptions – for example that achievement is proportional to the sum of potential and that it is a normally distributed variable independent from it which provides the deviation of the actual from the potential – the share of underachievers is always smaller than in the hypothetical situation where potential and achievement are fully independent and uncorrelated. Assuming that our chosen concepts hold, the number of underachievers should therefore never be greater than the number of underachievers in a world where potential has no achievement-promoting effect at all (but also no systematically detrimental one). This last number can be calculated as 24.0%. To obtain this number, one examines the uncorrelated values of potential and achievement (each standard normally distributed) and calculates the probability that their difference (which is then normally distributed with the square root of 2 as standard deviation) is greater than 1. These values are available in statistics handbooks. Because of the usual scaling properties of normal distribution it is the same as the probability of a *standard* normal variable being greater than 1 *divided* by the square root of 2. In other words the number of underachievers can never be greater than 24%. This fact makes it appear doubly suspicious when the number of underachievers in the example above is overestimated by around 10%. Research results obtained from such an error-prone sample are therefore useless.

3.2.4 Other conceptualizations of the discrepancy

From the definition which holds that underachievers must remain two standard deviations behind their potential in achievement, one gets a maximum 7.8% of underachievers, so that an overestimation of one-half percentage point already corresponds to a relative error of at least 4% (and probably more, since the maximum amount, as we know, is only reached when potential and achievement have nothing at all to do with one another). This value is calculated analogously to the value above as the probability that a normally distributed value with a standard-deviation square root of 2 is at least 2 (which is the probability of a standard normal variable being at least 2 divided by the square root of 2). Nevertheless it appears that the systematic errors caused by test imprecision are less consequential, though still clearly perceptible, when a stricter underachievement definition is used. But a stricter underachievement definition reduces the practical significance of the problem. Under the very strict criterion that an underachiever is a person whose potential is 96% or higher (thus 1.75 standard deviations over the average) and whose achievement is below the average (cf. Hanses & Rost, 1998), less than 1% of the gifted qualify as phantom underachievers, with a maximum of 2% underachievers in the whole sample. Here underachievement thus nearly loses practical relevance.

Under the equally widespread underachievement criterion of potential in the upper one-fourth (i.e., 0.67 standard deviations over the average) and below-average achievement (cf. Shaw, 1964), 8% turn out to be phantom underachievers with a maximum of 12.5% being underachievers. Thus an extremely large relative error is the result.

3.3 Points of empirical critique

In this section we make a few critical remarks supported by representative empirical findings regarding the “identity hypothesis,” according to which giftedness is nothing more than high intelligence. This interpretation was closely scrutinized during the critical phase. Since then, however, studies of underachievement have failed to address these doubts. In fact almost all operational definitions of underachievement are based on the identity hypothesis.

Underachievement conceptualized in this way is no more sensible as a scientific concept than high IQ would be as a synonym for giftedness. This appears even more doubtful in light of the current state of findings. We would like to offer a few points of criticism as examples.

Passow (1981) criticized the *empirical poverty of the IQ* already early on: gifts and talents are found in the most different expressions, forms, and sizes; the IQ, on the other hand, is just a single number which gives no indication of the kinds of focused support that should be undertaken. Passows's concerns are shared by other researchers.

The IQ also shows too much *instability* for being a good predictor of achievement excellence. The most relevant German longitudinal study (Weinert, 1998), for example, indicates that the correlations between younger age-groups and adult groups were low to, at best, moderate (Schneider, Bullock, & Sodian, 1998). This pattern of findings was already seen in the very first systematic study on the topic (cf. Downing, 1962), in which enormous IQ variation between the age of six and eighteen came to light. In no less than 58% of the children the IQ increase between school entry and adulthood was more than one standard deviation, that is, at least 15 points. In one-third of the children the difference even exceeded 20 IQ points.

The instability of the IQ is one of the reasons it is *unsuitable for the prognosis of excellence in achievement*. Already Terman and Oden (1959) had to admit in their classic study that a high IQ is no guarantee for excellence. Holahan and Sears (1995) even found that Terman's "geniuses," as the latter himself named them, were only as successful as randomly sampled persons from the same socio-economic background – regardless of how high their IQ was. Terman even omitted two later Nobel Prize winners from his final study sample because their IQs were too low.

Other longitudinal studies in which IQ and high achievement were investigated have yielded nearly identical results (e.g., Deary, 2006; Firkowska-Mankiewicz, 2002). The study by Subotnik, Kassan, Summers, & Wasser (1993) focusing on children with an extremely

high intelligence quotient (their average IQ was 157) found that none of these persons had achieved excellence by 40 to 50 years of age. Even the so-called American "wunderkinder" (Feldman & Goldsmith, 1986) all lost their advantage in adulthood.

High achievers typically have an IQ markedly below the threshold value most often considered the boundary to being gifted. Rost (2000) examined ninth-grade youngsters from 156 randomly chosen secondary schools. Those students who showed the best school achievement were classified as high-achieving. As these very best students had a mean IQ of 117, only 15% of them were highly gifted according to the most-used German IQ criterion of 130.

Four more problems with the IQ are important in this context and deserve to be at least mentioned (see Ziegler, 2008a). (1) It was recognized early on that the raw values from intelligence tests do not form a normal distribution. (2) IQ tests are not capable of correctly measuring extremely high or low IQ values. (3) Intelligence tests identify academically strong students but cannot predict excellence. (4) The results of different IQ tests can vary dramatically, particularly in the high-score range.

4. The future of the underachievement concept

The aforementioned explanations lend weight to doubts about whether the concept of underachievement is, in its current form, scientifically tenable as a discrepancy between IQ and achievement (see also Borland, 2003). At the very least, the danger should have become clear that its function as "monster-barring" probably hinders more than helps the theoretical progress of giftedness research. Despite these doubts, we do not conclude that the topic of underachievement is necessarily a dead-end for giftedness research which should be abandoned. Rather, out of practical as well as theoretical interest, further conceptional development is necessary.

4.1 The practical interest in further development of the underachievement construct

The study of the phenomenon of giftedness can be justified from a praxeological point of view in two ways (see Ziegler, 2009), which are also applicable to the phenomenon of underachievement. First, from a *societal perspective*: more than 50 years ago, Gowan described underachievers as "one of the greatest social wastes of our culture" (1955, p. 247). Indeed, our society has a vital interest in excellence (Heller & Ziegler, 2007).

Second, from the *individual perspective*: all talented individuals should have the opportunity to attain excellence. A talented person can be classified at any point in her or his development as one of three types:

- *Achievers* are talented (or gifted persons) whose development progresses towards excellence as expected.
- *Dropouts* are once-talented persons who no longer can achieve excellence – for example, because of having had insufficient support.
- *Underachievers* are highly at risk of also becoming dropouts.

As a rule, underachievers produce – though as the introductory definition states, not at all necessarily – unexpectedly low achievement levels. Thus, typically, the potential accomplishments of underachievers are distinctly underestimated, and therefore support for them is mostly not proportionate to their actual need but rather to the undeservedly low level of expectations placed on them. This effect, known in the literature as the *Golem effect* (e.g., Ziegler, Broome, & Heller, 1999) or the *Matilda effect* (e.g., Rossiter, 1993), describes a typically downward spiral of achievement development. It represents a further reason why underachievement should be promptly and decisively redressed: unrecognized underachievers do not only become dropouts, but also tend to face even greater achievement deficits.

4.2 Theoretical interest in further development of the underachievement construct

The simplified giftedness model underlying the concept of underachievement used in this paper posited a simple mechanistic relationship between intelligence and excellence of the form:

Intelligence → excellence

If disturbing influences are present, this simple relationship can become fractured; and stronger disturbances can even lead to drastic declines in accomplishment, namely to underachievement. Various studies (e.g., Anastasi, 1976; Borland, 2003; Passow, 1981) have pointed out, however, that tying underachievement to IQ is inadvisable. Instead, as a first step, the basic model should be more generally conceived (see Figure 1). Intelligence can then in principle still be treated as a predictor, but it does not have to be. The basic model is conceived so generally that it could be instantiated by all currently known giftedness models (cf. Sternberg & Davidson, 2005). But wherein lies the usefulness of this more general model?

The point has been made above that in ascribing talent or giftedness to someone we as researchers are essentially expressing subjective probabilities that at some point this person can achieve excellence. There are two main reasons why this expectation may deceive us (excluding measurement errors). The first is that our expectation may rest on false theoretical assumptions, which have to be corrected. Underachievement functions then as a *theory alarm* telling us to improve our theory.

The second main reason is that an actually expected outcome may fail to occur. Various researchers such as Gagné (2004) therefore explicitly introduce chance into their model. In a certain sense, this is a capitulation before the task of specifying more exactly the ceteris-paribus conditions (i.e., “plausible marginal conditions”; cf. Ziegler & Heller, 2000) under which the prognoses of a theory can be valid. Let us assume, for example, that we had made a prognosis that a certain pupil X will reach excellence in mathematics. According to the definition we have chosen, X would be considered gifted. Then suddenly X’s achievement

declines. An investigation shows that X had suffered through the extraordinarily poor mathematics instruction of a teacher who, perceiving X as a competitor, also tried to embarrass X in classroom situations. Such an obstacle does not necessarily give cause to improve our theory, but we might then choose to set more precisely the ceteris-paribus conditions under which we make claims for its validity. Underachievement would then, in such a case, function as a *theoretical alarm to make us render more precise the ceteris-paribus conditions of our theory.*

In sum, the phenomenon of underachievement arises because our giftedness models are not sure prognosticators. It was demonstrated above that there are compelling practical reasons for taking the phenomenon of underachievement seriously and intervening to prevent or stop it. This applies to teaching staff, parents, mentors, trainers, and the like. As researchers, however, we have considered the phenomenon from a theoretical perspective. The observation of underachievement informs us that we have to either revise our theory or the marginal conditions under which it is held to be valid.

Which optimizations we should undertake can only be decided in each individual case. In the simplest case there is no theoretical quarrel with the predictors, so that the correction is typically made according to the ceteris-paribus conditions. To give one example: so-called football scouts are interested primarily in being able to predict who can become a successful professional player; in such a case, theoretical claims retreat accordingly into the background. Elaborate demands such as the inus-conditions of good explanations, as they are required for example by the giftedness researchers Phillipson and McCann (2007), are then not met. Although predicting academic achievement works fairly well, the prognosis of excellence is currently beyond the realm of the possible (Ziegler, 2008b). Only recently has it begun to be apparent how complex the actual conditions for the development of excellence are and how short of the mark our explanations fall (Dai, 2009; Sternberg & Davidson, 2005). At least in

the medium term it will have to be our basic aim to set up strong prognostic models to serve as a theoretical springboard for explanatory theories.

5. Summary and outlook

Various parties share an interest in the phenomenon of underachievement. *Modern societies* have a great need for high achievers. Because underachievers are defined as persons who could essentially still achieve excellence, they signal the need for pedagogical intervention. Furthermore, *talented persons* have a right that their path to accomplishment is at least not blocked by unnecessary external barriers; and awareness of this right is also of importance for those who are interested in their development and accomplishments (*family, teachers, professors, friends, etc.*). Finally, as *giftedness researchers* we are interested in underachievement, but we have to observe a few "rules of the game", which in the past were, alas, all too often neglected.

First of all, we need a highly efficient – and, ideally, also highly explanatory – prognostic model for achievement excellence. The IQ, preferred until now, is to our present knowledge not up to this job (see also Stoeger, 2006). Second, the statistical foundations of this prognostic model must be evident. In this contribution we have illustrated this for IQ-based definitions of underachievement. Third, methods of dealing theoretically with the appearance of underachievers must be specified without the phenomenon of underachievement being cultivated and promulgated theoretically as a separate field of research. Rather we must make clear whether and how we want to modify our theories or their ceteris-paribus conditions when underachievers are found.

In conclusion, we want to mention the most important desideratum for future research on underachievement. As the research has to be done on the basis of a sound theory of giftedness (e.g., Gagné, 2004; Heller, Perleth, & Lim, 2005; Mönks, 1995; Ziegler, 2005), an obvious shortcoming of most theories is that they have yet to be systematically evaluated and little is known of their prognostic quality. Thus, a simple and, from a pragmatic point of view,

unobjectionable option in this difficult situation is to just use the best predictor, and this is not the IQ, but quite clearly a person's *previous achievements* (Lohmann, 2005; Ziegler, 2008a). The best indicator of underachievement is currently therefore either an (unexpected) sharp decline in achievement of a high achieving person or an unfulfilled positive expectation based on previous achievement. Two questions thus arise with which giftedness research must now grapple: at what points can achievement be considered high achievement, and at what point should a drop in achievement or an unfulfilled prediction of achievement be viewed as significant enough to be called underachievement?

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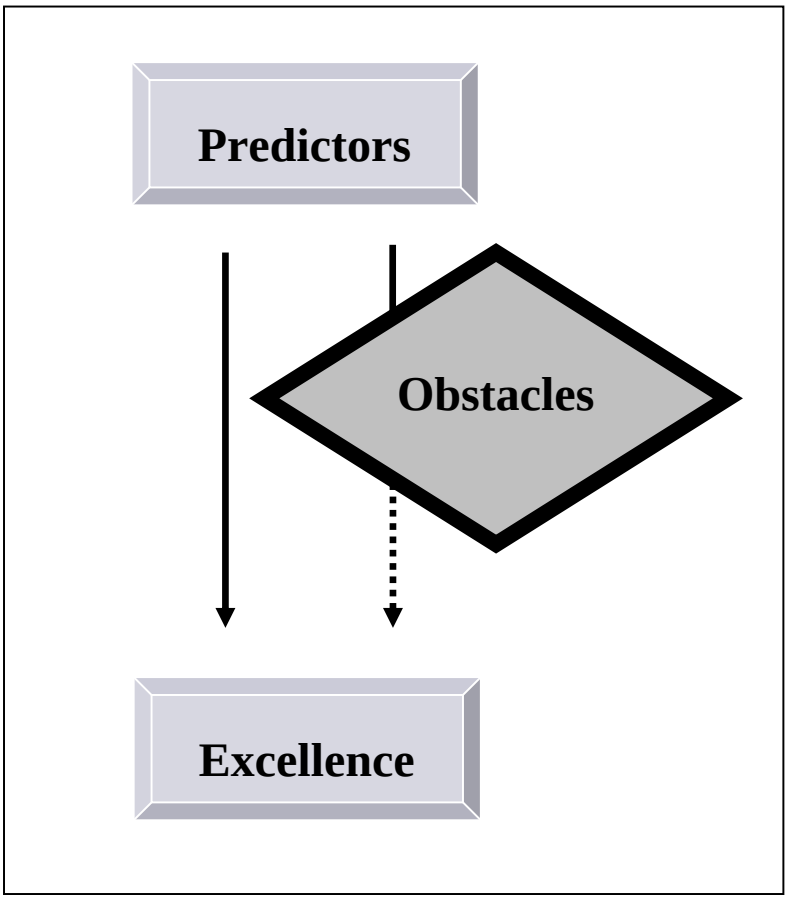
Table 1: Percentages of measured underachievers despite perfect correlation of potential and achievement

Sum of reliabilities of tests for achievement and potential	Percent of underachievers measured
2.0 (perfect tests)	0%
1.8	1.28%
1.6	5.71%
1.4	9.85%
1.2	13.14%
1.0	15.87%
still less reliable tests	still greater error amounts

Figure 1: Basic model of the determining elements in underachievement



Footnotes:

[1] In this definition only “talented” persons but not the “gifted” are called “underachievers.” The reason results directly from two further sub-definitions (cf. Ziegler, 2008a, p. 17): The talented are persons who *possibly* at some time will reach excellence in achievement. The term “gifted” is restricted, on the other hand, to persons who *probably* at some time will achieve excellence. For the sake of completeness, the definition of “expert” (excellent or eminent achiever) should be added: persons who *with certainty* have already achieved excellence.