Gifted Education from a Systemic Perspective: The Importance of Educational Capital and Learning Capital for the Development of Actiotopes

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Abstract

In this contribution the development of excellence of individual actiotopes is treated under the aspects of adaptation and regulation. First, several identifying characteristics of the development of excellence are given. It is proposed that the development of excellence be interpreted as a process of adaptation to certain environments. Its result is functional action repertoires in talent domains. Two types of regulation are distinguished: homeostatic and allostatic regulation. This is followed by replies to two central questions: Who regulates and what is regulated during the development of excellence? Here endogenous and exogenous resources are discussed and the concepts ‘educational capital’ and ‘learning capital’ introduced. To conclude, a thorough re-orientation of gifted education is advocated. In support of the regulation processes necessary during the development of excellence, attention to four principles is recommended: 1) The principle of the co-evolution of the components of the actiotope, 2) the principle of dynamic-interactive regulation, 3) the principle of capital orientation, and 4) the constructivist, or learning-path principle.
The assertion that people change over the course of time is a commonplace. But less trivial are the observations that many of these changes are possible only as the result of the coordinated actions of a very great number of processes, and their emergence is therefore extremely unlikely. Among these can be reckoned without a doubt the development of excellence. Unlike many processes that take place without our own intervention, here it is a matter of an active process needing to be intensively formed, the result of which, externally labelled ‘excellence’, is preceded by an immense number of successful regulations or adjustments. This implies the necessity of gifted education.

In explanations of excellence, two paradigms are dominant: (1) Some giftedness researchers consider it as an ‘exprimation’ (expression) of gifts (e.g. Gagné, 2011), while others conceive it as (2) the result of a person’s acquisition of skills (e.g. Gruber & Ziegler, 1996). Both viewpoints have been repeatedly questioned because of their organismic asymmetry (Davids & Araújo, 2010; Dunwoody, 2006; Ziegler, 2008). The core of these critiques is the theories’ exclusive location of excellence so to speak within the person (cf. Araújo & Davids, 2011; Ziegler, 2005). This approach however leads to an unjustified narrowing of the research horizon, being either limited to processes of the transformation of internal entities (e.g. of genetically fixed gifts into talents, cf. Gagné, 2011), or, reduced to the responsible internal conditions (e.g. the construction of an elaborated knowledge base, cf. Ericsson, Nandagopal, & Roring, 2009). This however represents an artificial decontextualisation of gifts and abilities (cf. Brunswik, 1955; Turvey & Shaw, 1995).

Bickhard (2008) draws attention to the fact that decontextualised conceptualisations of the research object are in no way unusual. But they are typical of the beginning phase, a still immature state, of a scientific (sub-)discipline. The immaturity is seen for example in the research object still being considered a kind of stable substance or characteristic, which currently applies to the approaches of the vast majority of giftedness and excellence researchers and their view of gifts, talents and excellence development (cf. Ziegler, 2008). The necessary, subsequent step, thus Bickhard (2008), must be that of the development of a processual conceptualisation of the research object.

Very promising in regard to this are ecological and systemic approaches in psychology, and especially, excellence development (e.g. Gibson & Pick, 2000; Vicente & Wang, 1998; Ziegler, 2005). They conceptualise excellence as the result of successful adaptations to specific (performance) contexts (cf. Gruber, Jansen, Marienhagen, & Altenmüller, 2010). In consideration is therefore not only the person, but nominally the person and the environment, to which the person functionally adapts. Excellence is thus also never a ‘possession’ of the excellently-performing person, but rather only a (strongly culturally defined) label that applies only to certain behavioral contexts.

**Excellence development as adaptation and regulation process**

Excellence is attributed to persons in which are credibly observed numerous and effective interaction possibilities with the dynamic, complex environments that constitute a talent domain. Frequently these effective actions themselves are also qualified as excellent.

It should be kept in mind that actions that we call excellent, make sense, or are functional, only within the domain in question. To illustrate this with a somewhat drastic example: We will understand why, as members of our cultural community, a diver plunges into the pool after a forward dolphin spin with one-and-a-half twist. The very same manoeuvre we would observe full of incomprehension if a diver did it from the balcony at home. Therefore the person involved and the context of their action must always be kept in mind. For this reason also, the question ‘Smart people or smart contexts?’ posed by Barab and Plucker (2002) regarding the main determinants of excellence development, cannot really be
determined. Since the person and environment form one system, an actiotope\(^1\) ‘smartness’ can only be ascribed to the system as a whole: An effective action repertoire acquired over a long period of adaptation is functional only in the particular (performance) context of a domain.

The fruitfulness of a theoretical approach is measured above all by two criteria: Can it generate new, interesting research questions, and, what can it contribute to the understanding of observational data in a research field?

**The contextualist perspective**

A systemic-ecological approach brings a long overdue, fully neglected perspective into the observations on excellence. Traditionally, excellence research has focussed exclusively on the individual. The desire was to know whether and how a certain person could achieve excellence. In fact however, one could just as well ask from a contextualist perspective:

- How high is the probability that in the next 30 years a woman from China will win the Nobel Prize for physics?
- How high is the probability that a ski jumper from Saudi Arabia will win a medal in the Winter Olympic Games of 2014 in Sotschi?
- How high is the probability that in the PISA results of 2018 the average performance in mathematics in the 97th percentile of British pupils will lie above the average performance of the 97th percentile of French pupils?

Such questions burst the bounds of the individualist perspective on excellence and show its need to be extended. The probability of excellence is decided evidently not only in the individual, but is also a question of system.

The individualist perspective, that is, whether an individual can achieve excellence, requires thus the complement of the contextualist perspective. Together they can form a dynamic-interactive perspective on the individual and environment equally. This paradigm shift is particularly crucial whenever the question is approached, how a society can increase the probability of the emergence of excellence, for here traditional ‘gifted education’, with its individualist approach, collides very soon with its own limitations.

**Selected evidence**

The fruitfulness of a contextualist perspective is demonstrated in the following only by means of examples of findings. This is due to the fact that research in the development of excellence has to date hardly led to any robust empirical evidence on the level of usual methodological standards of empirical research. The instead rather anecdotal findings concern the learning process, the social as well as cultural surroundings, and the role of resources.

**Learning process:** The development of excellence is interpreted by most excellence researchers as an enormous learning process. Studies show that it takes at least ten years (cf. Ericsson, Charness, Feltovich, & Hoffman, 2006). During this period, a person spends a minimum of circa 10,000 active, concentrated hours of learning. In recent years on the basis of research studies in many domains a quite dependable picture of excellence development has been sketched.

The learning activities are no isolated, randomly begun episodes, but rather targeted behaviors serving to improve the current state of learning. They can be described as a coordinated movement through carefully arranged learning sociotopes\(^2\) that are modified in accord with the increasing competence level (Ziegler, in press). Each new learning step

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\(^1\) For the concept of the actiotope, see below.
\(^2\) Ziegler (2009) defines a learning sociotope as a stable situative arrangement that permits learning increases.
requires the creation of a new learning situation precisely adjusted to the current state of competence. When for example a talented pianist has mastered an etude, the piano teacher will carefully select the next one that should reflect the new, higher competence level and offer an optimal learning opportunity. Excellence development should thus offer an orderly learning cascade of systematically arranged and sequenced learning environments conceptually sequenced as adaptations.

**Social environment:** In his path-breaking study Bloom (1985a) interviewed 120 persons who had achieved excellence in various domains. He found that they had grown up in individually structured learning environments, for which in most cases a personal mentor had been responsible (Bloom, 1985b). The ability of these mentors to set again and again new learning challenges and create the learning occasions appropriate to them, was for Bloom a precondition to the children’s reaching the excellence level. Further research confirms that the social learning-environment makes a crucial contribution to the achievement of excellence (cf. Sosniak, 2006). Its function however is not only that it in some sense awakes the exceptional gifts resting below the surface in the person showing talent, for these will awake from their slumber at some point anyway. Rather, it makes available the active interaction partners who can develop excellence together with the talented individuals.

Important ‘persons in the shadow’ (cf. Gruber, Lehtinen, Palonen, & Degner, 2008; Gruber & Westermeier, in press) are however not only the ones who take over a direct teaching function in the domain, for among them are also persons such as spouses, partners and parents who stabilise the actiotype of the talented individual by facilitating things like daily routines, or who can unlock access to fields where excellence can emerge, e.g. athletes’ or performers’ agents (Hancock, Ste-Marie, & Schinke, 2010).

**Cultural environment:** There are multiple indications that excellently performing individuals only through and in the confrontation with the surrounding culture surrounding could first develop their specific excellence. A very good example is the existence of so-called ‘golden ages’ in which prominent representatives of a domain emerge in astonishing numbers. Two famous groups of artists are the musicians Quantz, Hasse, the Marcello brothers, the two Scarlattis, Cimarosa, Lotti, Galuppi, Caldero, Jommelli, Parpora, Albinoni, Tartini, Haendel and Vivaldi on the one hand; and The Byrds, Kinks, Motoerhead, Nirvana, The Police, The Who, Rolling Stones, Sex Pistols, David Bowie, George Michael, Phil Collins, Cat Stevens, Peter Frampton and Elton John on the other. The members of the first group developed their musical excellence in, among other places, 18th-century Venice, where they were all active within a 50-year period. The second group comprised London musicians and bands from the second half of the 20th century. Even if the two groups differ in the characteristics of their music, internally they exhibit great similarities (e.g. in composing style and instrumentation). Each ‘individual’ artist’s or band’s style is thus definitely not purely individual, but rather can only be adequately understood as an interaction of the individual and the musical culture dominating in a specific geo-cultural area of the time.

**Resources:** The important role of resources (a systematisation of resources is to follow) that must be applied in the development of excellence is a further significant indication of the necessity for a dynamic-interactive perspective. For example, the complete absence of Ethiopian Olympic champions in luge can in no way be taken as a lack of individuals with luge talent in Ethiopia. But even the most talented would find there no adequate support conditions. By contrast Germany and Austria are considered the most successful luge nations in the world, since they have won c. 60% of all Olympic medals in the past. Initial successes led to improvements in the already excellent infrastructure, so that Germany could not only stabilise, but even advance its head start. For example, the German women have lost only one
of all World Luge Championships since 1997. Currently Germany is the only European country that possesses more than one facility (it has four) on which only international competitions are allowed to be held. Furthermore during the whole year they offer excellent training conditions. The great success of the Germans is therefore definitely not only due to their individual sledding talents, but also and not insignificantly to the creation of training facilities that are unique by worldwide comparison.

A systemic approach: the Actiotope Model

Csikszentmihalyi (1996) in his interviews with especially successful persons – Nobel Prize laureates, exceptional creative artists, etc. – arrived at the conclusion that excellence is not localised in the person, but in the system of the person and environment: A person exhibits actions that in certain contexts are accorded the label ‘excellent’. This way of looking at the matter raises a series of theoretically important questions. How can acquisition, usage and the best possible support conditions of excellent actions best be analysed?

The Actiotope Model attempts to provide these answers on the basis of a systemic approach. Excellence should be understood as the consequence of an enormous number of successful adaptations to environments. Expressed differently and more concretely: A constantly richer action repertoire is built up that permits not only more, but also more effective actions in a talent domain.

An actiotope consists of the acting individual and the environment with which he/she interacts in his/her actions.

An actiotope is not static and unchangeable, but is changed as each new goal is set during development of excellence. The adaptation comprises in equal importance the four components of the actiotope (for details see Ziegler, 2005).

First, an action repertoire is built up that makes possible functional actions in the talent domain. Second, the goals must be adjusted repeatedly, which is important above all so that learning does not remain at a sub-optimal level. Third, for the permanent widening of the action repertoire are necessary constantly new environments that offer optimal learning conditions for each awaiting learning step. Forth, each possibility of a further action opens access to the challenge of a new goal. These can be realised in a continually growing number of contexts. If for example multiplication has been learned, this skill can be applied to many new goals in very different situations. There is thus a need to coordinate a richer action repertoire, more diverse goals and more numerous contexts. In terms of the Actiotope Model this means that the subjective action space must be adapted. In it the possibilities for action are generated and selected. The latter occurs when the situatively best action for reaching the currently pursued goal is selected from the action repertoire.

Regulation types

During the development of excellence, individuals find themselves in a permanent process of targeted (self-)modification, the most visible result of which is an increasingly functional action repertoire in some domain. Such adaptations to a domain are however evidently not autocatalytic, i.e. processes proceeding by themselves, but rather are such that require multiple regulations (cf. Alexander, Dinsmore, Parkinson, & Winters, in press).

By regulation is understood the directed influencing of system behavior, i.e. the transition from one condition to another.
Gifted education must realise that the development of excellence consists of an extended sequence of highly structured, successful learning episodes. Such orderly processes are not self-evident, but the result of regulations. Unfortunately, most regulations are still unknown, and of those that are known, almost all are still rather poorly understood. But it is apparent that there are at least two types of regulations: homeostatic, and allostatic, with the second especially characteristic for the development of excellence.

The concept of homeostatic regulations and their limitations in explaining the development of excellence

During the development of excellence, the usual regulation processes typical for human beings are always ‘running in the background’, so to speak. Among these are thermo- and osmoregulation, emotive regulation and the maintenance of social relation structures (e.g. familial interaction patterns). In these it is (mostly) a matter of homeostatic processes that serve to maintain the required steady states.

In the explanation of the development of excellence however, the homeostasis concept evidently has its limits, since the development of excellence aims precisely not to maintain steady states, but purposely change them. In fact researchers of differing theoretical provenance have already objected that the homeostasis concept can only unsatisfactorily take in all the behaviors that serve to change the subject and lead to modifications of goal states (cf. Kanfer, 1987; Maturana & Varela, 1991). This leaves two paths open: If a theoretical concept shows itself to be insufficient, it is usually either replaced by a better concept that allows a greater range, or, it is augmented with a complementary concept, so that the phenomenal area of interest is (more) completely captured (Stegmüller, 1976).

In the present case, the first path indeed seems less advantageous. While various further developments in the homeostasis concept have been discussed, the most prominent being ‘homeodynamics’ (cf. Maturana & Varela, 1991), they all share the same serious disadvantage: the unsuccessful attempt to extend the homeostasis concept from the maintenance of nominal states to the new concept. For this reason the second path, the introduction of an additional concept, is preferred.

Allostatic regulations during the development of excellence

We should thus seek a complementary concept to homeostasis. The combined reach of the two concepts should be great enough to describe all the regulations occurring during the development of excellence. In the search for a concept it is advantageous to remember in advance as an aid to orientation two striking characteristics of the development of excellence. In regard to the development of excellence the quantity in terms of time of the necessary learning processes, and the quality of these experiences, pose enormous explanatory problems.

One of the first attempts to quantify the development of excellence was undertaken by Simon and Gilmartin (1973). They estimated through computer simulation the number of domain-specific units of knowledge which an excellence-level performing person must have at their disposal, at ca. 100,000. This estimate is however probably too low (Ziegler & Phillipson, in press). But even if the number were not much higher, it would be mistaken to believe that for their acquisition only just that many learning episodes, i.e. 100,000, were necessary. For naturally there also have to be learned many connections that exist between the
units of knowledge. In addition erroneous items may be learned which have to be corrected – often with considerable trouble (Ericsson et al., 2006).

In a qualitative assessment of these learning processes, surprising is their largely negative – and to some extent downright aversive – quality as experiences (Ericsson, 1998; Ericsson, Krampe, & Tesch-Roemer, 1993).

Quantitative and qualitative observations pose thus the question, how some persons can succeed in directing their actions steadily over such long periods, when they experience these actions negatively in great part? To express this in technical terminology: Why do these persons maintain themselves in a meta-stable state during their development of excellence over periods of years? Why do further regulations lead repeatedly to attaining a further meta-stable state, while the process of transition is associated with (often) negative emotional qualities? Wouldn’t it be here much simpler to forego the daunting adventure of the development of excellence, and aim instead for a stable state which at least does not feature the negative emotional quality of the former and perhaps even provides some level of satisfaction?

One of the popular answers to this problem says that talented individuals who hold through this task are precisely those possessed of an enormous motivation (the ‘rage to master’) that drives them ever further (cf. Winner, 1996). Whether this answer is correct can be neglected for the moment, since we are dealing here with regulation types. Motivation could at the most offer an explanation for why someone regulates with great determination, but gives no clue about which form of regulation is involved.

Very promising analytic possibilities for the quantitative and qualitative characteristics of the development of excellence as discussed above offers the concept of allostasis, originally developed in medicine by McEwen and Stellar (1993). It refers to mechanisms of the targeted adjustment of the organism in reaction to challenges. An important characteristic here is that continually new resources must be activated in order to attain (meta-)stable states. To make allostasis a suitably complementary concept to homeostasis, we define it for our purposes as follows:

**Allostatic regulations serve to attain new, adjusted steady states, which each time require the activation of new resources.**

With the homeostasis and allostasis concepts can be analysed all the regulations occurring during the development of excellence, i.e. such which serve the maintenance or attainment of newly adjusted nominal levels. In particular there are now also accessible those regulations during the development of excellence that show one or both of the following two characteristics: (1) The regulations adjust the (new) target states (for example, yesterday’s target state of learning, i.e. yesterday’s just attainable learning goal, is today too low because of increased competence). (2) The regulations activate advantageous resources (for example, ‘didactic educational capital’, see below) for attainment of the new target state, so that the new target state actually become attainable.

In regard to the second characteristic, the question arises what resources this could be, which has until now not been systematically investigated either in giftedness or excellence research. This shall be attempted with the presentation of the following systematisation.

**Resources**

How is the development of excellence regulated and what resources are used for this? Above all biographical analyses of persons performing at the excellence level provide various indications (e.g. Bloom, 1985b; Simonton, 1977; Wallace & Gruber, 1989). On their basis we propose a differentiation between two kinds of resources. Endogenous resources can be
regulated only through a system and its subsystems. Because we are focussing on the development of excellence, we are referring in the following only to individuals. Exogenous resources can be regulated equally through the system (in this case, the individual) as well as further systems (e.g. family, society).

‘Resources’ are, by definition, means that can be employed to attain goals. To borrow from a now widely-used terminology, in the following they will be called various types of ‘capital’ (cf. Bourdieu, 1983). But undertaken will be a finer-grained categorisation of the variously appearing forms of capital. This is necessary among other reasons because for the first time exogenous and endogenous resources are differentiated. We will call them in the following educational capital and learning capital.3

Exogenous resources: educational capital

Many sciences grasp their object not as a singular entity, but as part of a field or system (Kauffmann, 1995). This makes it possible for them to deal with research questions from the already above recommended contextualist perspective. For the analysis of the problem that excellence is distributed unevenly over systems (e.g. different countries, or sports teams), Ziegler (in press) proposed the use of the concept of educational capital.

Educational capital is that which can (but needn’t be) employed for improvement of education and learning. It can be regulated through individuals as well as further systems.

The ‘degree of resolution’ of an analysis of educational capital can vary according to the question at hand. The system of interest can be an actioptope, a family, school, political district or educational system of a country. Central are the two questions: (1) What educational capital is available, and (2), how it is applied. For this, five forms of educational capital – that at least partially overlap – are identified (see Ziegler, in press).

Economic educational capital is every kind of wealth, possession, money or valuables that can be invested in the initiation and maintenance of educational and learning processes.

Economic educational capital plays in the support of excellence an overarching role, without this having received sufficient recognition until now in giftedness theories. If one compares societal systems, one finds particular clusters of excellence that closely correlate with the availability of economic capital (e.g. Hanushek & Kimko, 2000; Lynn & Vanhanen, 2002; Rindermann, Sailer, & Thompson, 2009). And educational systems indeed claim a considerable proportion of the public expenditures of nations. The same is true for the total of top-level support, for which unfortunately there are no meaningful statistics. Yet many relations are evident. For example, Nobel Prizes for science are won exclusively by researchers from institutions in economically strong countries with high per capita gross national product. Without the strong engagement of economic educational capital, many inventions and innovations are simply impossible. Some research fields (e.g. particle physics) require extremely large investments that only the richest countries can afford (cf. Ammermueller & Lauer, 2007).

3 The concept "capital" was for four reasons preferred over that of "resource". First, it can reasonably take on a negative value (e.g. debt); second, various types of capital are (at least within limits) convertible; third, capital connotes, better than resource, that it - as a rule - must be earned and, fourth, can grow.
Economic educational capital is naturally also applied as targeted support for individuals. It is used for example to pay for stimulating toys, special tutors and mentors, musical instruments and instruction, sports equipment, good schools and much more.

Economic investments in education and excellence bring numerous secondary effects, which underscores the necessity for a complementary, contextualist perspective. They attract, for example, human resources, as when top-class research institutions can with greater probability attract and engage high-performing researchers, often also from other countries. The superior research opportunities [and facilities] permit the newcomers to do still better research, so that a positive feedback effects results.

Cultural educational capital includes value systems, thinking patterns, models and the like, which can advantage – or hinder – the attainment of learning and educational goals.

The research literature on the topic contains many indications that culture influences the emergence of excellence. The example of the ‘golden age’ was already mentioned (cf. Pfleiderer, 1877). Culture can however also refer to smaller systems, such as religious communities (as in Max Weber’s famous ‘Protestant work ethic’; Weber, 1934), elite schools and universities, orchestras or sports teams. Culture can naturally also hinder the emergence of excellence and thus be ‘negative cultural capital’.

There are also now interesting research results on how culture affects individual action (e.g. in ‘stereotype threat’, cf. Martiny & Goetz, 2011; Steele, James, & Barnett, 2002, or ‘dysfunctional attributive styles’, cf. Campbell & Henry, 1999; Nauta, Epperson, & Waggoner, 1999). For example culture is unfavourable to women’s development of excellence in STEM fields when in the culture of origin the conviction dominates that they are less well suited to achieve in these areas (Dweck, 1999). And in fact the rates of women’s participation in STEM fields around the world are especially low wherever this stereotype is strongly manifested (Stoeger, 2007). It is no accident that, despite women’s possessing probably comparable gifts, during the whole of the 20th century only five managed to win Nobel Prizes in the natural sciences.

Social educational capital includes all persons and social institutions that can directly or indirectly contribute to the success of learning and educational processes.

Social educational capital can be employed to directly improve learning processes. But it can also create for the learning process more favorable surrounding conditions.

Social educational capital applied directly to improve learning processes includes mentors, trainers, pedagogues, teachers, professors, teacher organisations, etc. The greater their number, their personal engagement and their teaching and supporting abilities, the greater is the probability of excellence emerging.

Learning is a situationally embedded process. Social educational capital can be the means to getting access at all to specific learning situations (e.g. through sponsoring, scholarships, social connections, support associations or networks) or for improving the situative learning conditions (e.g. supportive partners, engaged parents, neighbourhood helpers). A striking example is the typically very contrasting availability of social educational capital to central European men and women interested in STEM fields (Stoeger, 2007). While a woman is often the positive social educational capital for her male partner by supporting his career in a STEM field, the male partner unfortunately often represents negative social educational capital for a female partner, if for example he makes excessive claims on her

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4 STEM is the acronym for Science, Technology, Engineering and Mathematics.
availability for household and (child-)care duties and thereby cuts drastically her learning opportunities.

Infrastructural educational capital means all materially implemented possibilities for action that permit learning and education to take place.

Infrastructural educational capital influences the chances of excellence in two ways. The availability of infrastructure can, first, awake interest. A sports field in the neighbourhood increases the probability that a child will come there to play football; a nearby swimming pool raises the chances that a child will learn to swim. Second, infrastructural educational capital offer specific learning possibilities. The example of the excellent infrastructural conditions for sledging in Germany with the worldwide highest number of professional facilities has already been mentioned. Many more examples could be given, ranging from the equipping of preschools with high-quality play and learning materials, schools with learning media, to the institution of tertiary education facilities, all the way to special research programs such as CERN.

Didactic educational capital means the assembled know-how involved in the design and improvement of educational and learning processes.

For almost all domains that attract enough interest, in recent decades the average and top performance levels have risen. What were earlier practically unplayable music pieces now belong to the standard repertoire of professional musicians, world records have been repeatedly dramatically surpassed and, if IQ tests were not continually adjusted, the average IQ would also have significantly risen in recent decades (e.g. Flynn, 1987, 2007). These rises in performance levels are due not least to enormous increases in didactic educational capital. Improved training methods, superior teaching planning, perfected instruction techniques, pedagogically better organised learning feedback, more finely structured learning sequences, targeted improvements in individual learning competence etc., make possible ever higher returns on learning effort in ever briefer periods. Thus today’s advanced high-school students can demonstrate possession of mathematics skills that the best mathematical minds of earlier centuries needed decades of study to master.

Endogenous resources

Learning capital includes that which is exclusively accessible to individuals for improvement of education and learning.

Endogenous resources are subject exclusively to the regulation by the system (in our case, the individual) and its subsystems. This does not mean, however, that they cannot be indirectly, exogenously regulated. For example, parents attempt this by such pedagogical techniques as praise and blame. However praise and blame first need to be processed by the recipients, which is illustrated by, for example, paradoxical praise effects (cf. Binser & Foersterling, 2004).

Organismic learning capital consists of physiological and constitutional resources of a person.

The body of a person is an important constituent of every learning process. This seems trivial for what regards sports, in which health, conditioning, flexibility, endurance, power, etc. are the all-important determinants of effective training. Bodily fitness is however also an
important precondition for top-level cognitive activity (e.g. Bellisle, 2004; Gottfredson, 2004).

**Actional learning capital** means the action repertoire of a person – the totality of actions they are capable of performing.

Actions are not limited to voluntary motor movements. The fact is that arguments are available for a broad concept of action, as employed for example by the Actiotope Model (Ziegler, 2005). Actions comprise thereby all bodily changes intended to serve the attainment of action goals. This explicitly includes cognitive activities.

Persons differ as to what actions they could possibly carry out at a given point in time. That can be organismically grounded, for example, in differences in mobility, power or endurance. These interindividual differences can however also rest on differences in procedural or declarative knowledge (e.g. Anderson, 1976). Research studies have shown that the current action repertoire of a person is an excellent predictor of later performance (e.g. Ziegler, 2008). For this reason talent support is often directed towards those groups of persons who have already demonstrated notable performance, that is, have shown a high level of actional learning capital (e.g. Gershon, Kiderman & Beller, 1996; Roecker, Schotte, Niess, Horstmann, & Dickhuth, 1998).

**Telic learning capital** comprises the totality of a person’s anticipated goal states that offer possibilities for satisfying their needs.

Goals refer to states of the world (internal as well as external) that we wish to realise through actions. They have often been conceptualised as the result of very rapid decision-making processes in which we weigh up the probabilities of success and the values of possible alternative actions (cf. Atkinson’s pioneering studies of 1957, 1964). These and similar conceptualisations hide the fact that functional goal-settings are preceded by a learning history. People are constantly forced to adjust to changing environments. A part of the change is the result of a deliberate design of the environment to satisfy personal needs (e.g. agriculture, snack stands, clothing shops or public transportation). If its functionality is decreased, it is in the rule altered. But this has the consequence that the anticipatory (i.e. expected) goal states in which the satisfaction of needs can take place are permanently subjected to change. For example, we have to learn already as small children what things in our environment are edible. Noodles are edible, but not grass.

Telic learning capital, that is, the accessibility of functional goals for the learning process, is in at least two ways a significant resource during the development of excellence. It is, first, useful for the creation of favorable framework conditions of learning (e.g. planning rest-periods, so that the next learning step is undertaken in a condition of optimal fitness; setting up a functional workplace). Second, it can be employed to set up functional learning goals that promise greater competence growth (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002; cf. also the functionality of learning goal vs. performance goal orientations; e.g. Stoeger, 2002).

**Episodic learning capital** means the simultaneous goal- and situation-relevant action patterns that are accessible to a person.

In the most different domains (e.g. music, natural sciences, team sports, chess; numerous examples in Ericsson et al., 2006) it has been discovered that experts possess an enormous repertoire of standard solutions for typical situations. While actional learning capital comprises only possibilities of action, standard solutions contain effective couplings of
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(1a) infrastructural educational capital with (2a) actional and (3a) telic learning capital. More concretely, episodic learning capital consists of effective episodic knowledge that comprises (1b) potential action contexts as well as (2b) therein possible successful actions for the (3b) attainment of functional goals. Such episodes include for example automatic actions, accessible solution routines or intuitions. Thus it has been demonstrated for example in sports that experts better recognise and remember strategic moves (e.g. Starkes, 1987), are better able to anticipate actions of their opponents on the basis of their relevant experience (Abernethy, 1990; Abernethy, Neal, & Koning, 1994), and to structure flexibly and highly functionally the typical temporal progressions of play and their consequences (Gruber & Ziegler, 1993).

Attentive learning capital denotes the quantitative and qualitative attentional resources that a person can apply to learning.

Attentiveness has been conceptualised mainly from three perspectives as a limited resource. It is thought of in terms of: (1) the object for which one seeks attention (e.g. Franck, 1998); (2) as a temporally limited entity (can be evoked only for a certain time) (Ericsson, 1998); (3) as a selective limitation on tranches of perception; i.e., one cannot simultaneously focus on all of what one perceives (Navon & Goher, 1979; Schneider & Shiffrin, 1977). For the development of excellence, all three named aspects play an important role.

A domain must (1) attract the attention of a person so that they focus optimally (2) long and (3) selectively on the improvement of their performance. Just some degree of occupation with a domain is not enough to attain an excellent action repertoire in it. Particularly Ericsson (e.g. Ericsson et al., 1993) has repeatedly shown that to attain substantial performance gains, routinely extensive, well-planned sequences of learning behaviors are necessary (‘deliberate practice’). Their execution requires a very high level of attention. Interestingly, it becomes in turn characteristic of an increasing development of excellence, that ever better attentional performance is achieved (e.g. Abernethy & Russel, 1987).

**Four consequences for gifted education**

The development of excellence has been described in this contribution as an adaptation during which a functional action repertoire for specific talent domains is built up. Because this is not an autocatalytic process, numerous partial processes require regulation. On the one hand it is a matter here of homeostatic regulations aiming to maintain target states. On the other hand, allostatic regulations try to achieve modified target states by the application of new resources. The latter regulation type is characteristic of the actual development of excellence, that is, the acquisition of a functional repertoire of actions in a talent domain. The resources applied are educational capital and learning capital.

The adaptive process is directional and follows an incremental principle: The modification of the actiotope through regulations proceeds continuously in the direction of excellence (Ziegler, Fidelman, Reutlinger, Vialle, & Stoeger, 2010). Most persons who occupy themselves with a particular domain will however at some point cease with their learning efforts at some level of performance that seldom fully challenges the individual developmental possibilities. The regulation efforts thereby cease to be effective, are stopped from without or by the learners themselves. At these crucial points gifted education must intervene with help. Its task is to improve the adaptation of the actiotope towards excellence through measures to support the regulations. Four general principles, on the basis of which this should take place, shall be dealt with in conclusion. They imply a radical re-orientation of gifted education.
I) What is regulated? The principle of co-evolution of actiotope components

Systemic-ecological approaches proceed from the assumption that each localised change has an effect on the total system. Each learning step creates therefore the need for new regulation. In order that this not proceed chaotically, co-evolution is necessary, i.e. the system must develop further in an orderly way, so as to retain its stability. For gifted educations this means that educational objectives will not be attained if attention is concentrated only on the support of a single element. Gifted education support must therefore be holistic. Its goal is the further development of the total actiotope without threat to its stability. In the focus here is thus not only the continued acquisition of an excellent action repertoire, but in addition the coordinated adaptation of goals, environment and the subjective action space.

Gifted education is however full of examples of just how difficult the task of co-evolution is and how insufficiently known are the multiple feedback possibilities of actiotopes. An impressive example are the studies by Freeman (2006a, 2006b). They demonstrate how often even the smallest interventions in the course of development can overtax the regulation skills of pedagogues and produce serious negative consequences. Just the information, communicated to talented pupils, that they in fact are talented, is an enormous risk factor for their further development. Some of the empirically well-demonstrated risks indicated by Heller (2004) are “social isolation, development of egocentric attitudes and behaviors, endangering or disturbing the personality development and self-concept through extreme achievement pressures or too much responsibility” (p. 308). Indeed, he recommends that exclusively professional counsellors should inform persons about their special gifts (Heller, Reimann, & Senfter, 2005). Their expertise in regulation is simply greater.

2) Who controls the regulations? The principle of dynamic-interactive regulation

It should be evident that the development of excellence, in the rule, is not alone achieved by the learner. Trainers, mentors, giftedness counsellors etc., put at learners’ disposition didactic educational capital, open for them access to learning sociotopes, etc. (see Grassinger, Porath, & Ziegler, 2010). In short, the regulations require many types of cooperation and coordination between the learner, persons directing the learning process (e.g. mentors), but also persons who create the necessary framework conditions (parents, comprehending and supportive partners, etc.).

For gifted education, this means that the hope held by many that talented persons should be able to regulate the development of excellence largely themselves, is illusory. The occasional suggestions or advice from experts, summer-schools or enrichment programs are not sufficient. Instead, stable conditions for dynamic-interactive regulation, i.e. mentor-mentee relationships enriched with multiple resources, must be established and proven (Grassinger et al., 2010).

Unfortunately, the complexity of the necessary regulations is even in many mentoring situations dramatically underestimated (Stoeger, Ziegler, & Schimke, 2009). Necessary is therefore a much greater professionalisation than that assumed to be the case until now. ‘Classical’ regulation notions (simple cause-and-effect relations) hardly do justice to the reality. The regulations as dealt with here are characterised by effects, unintentional side-effects, consequences with multiple feedback loops, self-reinforcing mechanisms and non-linear transitions (Ziegler & Stoeger, 2009). In order to regulate actiotopes over a period of years, mentoring, coaching and the like do offer in principle a good framework. But still, high-level expertise in regulation must be added. Without professional, or at least very experienced, coaches, trainers, mentors or teachers, it can be today hardly expected to achieve excellence.
3) What resources do regulations require? The principle of capital orientation

This contribution has shown various examples of how, because of lack of resources, the process of excellence development can break down, or the phenomenon arrested performance can appear (Krampe & Ericsson, 1996). The many overt forms of exogenous and endogenous resources, i.e. educational and learning capital, have already been mentioned. Because the development of excellence requires that all of them be sufficiently available precisely when needed, they must be correspondingly taken into account in the identification of talent as well as in gifted education. This means that in talent identification, the availability of all five forms of educational capital and all five forms of learning capital must be surveyed. Gifted education must ensure that sufficient educational and learning capital is available to enable each new learning step to take place.

4) What is the chronological horizon of identification and support? The constructivist or learning-path principle

Identification of talent is mostly done with reference to the status quo; the future developmental possibilities are seldom examined in detail. In fact, however, future learning possibilities should be actively investigated and constructed. The projection should extend over periods that are much longer than the brief support and intervention periods of traditional talent support. The aim is to elaborate an individual ‘learning path’ which describes the construction of a functional learning repertoire in a domain up to the attainment of excellence. The supply of endogenous and exogenous resources must be, over the entire learning path, permanently available in sufficient amounts, or be able to be made so.

Literature


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