Review

Analyzing National Talent Support Systems: The Case for a Resource-Oriented Approach

Albert Ziegler *, Nick Naujoks-Schober, Wilma Vialle, Heidrun Stoeger

Posted Date: 27 April 2025

doi: 10.20944/preprints202504.2268.v1

Keywords: educational and learning capital; resource orchestration; systemic talent development; national talent support systems; excellence and equity; sustainable talent development

 doi:10.20944/preprints202504.2268.v1

Review

Analyzing National Talent Support Systems: The Case for a Resource-Oriented Approach

Albert Ziegler [1,*], Nick Naujoks-Schober [2], Wilma Vialle [2] and Heidrun Stoeger [2]

[1] Friedrich-Alexander University of Erlangen-Nuremberg; albert.ziegler@fau.de
[2] Ansbach University of Applied Sciences; nick.naujoks-schober@hs-ansbach.de
[1] University of Wollongong; wilma_vialle@uow.edu.au
[2] University of Regensburg; heidrun.stoeger@ur.de
* Correspondence: albert.ziegler@fau.de

Abstract: Context plays a critical role in talent development, yet most national analyses continue to rely on individual-centered talent concepts. This paper highlights the limitations of traditional models for assessing how countries support talent and proposes a resource-oriented, systemic alternative. Building on the Educational and Learning Capital Approach (ELCA), the study argues that national talent development depends on the availability, accessibility, and orchestration of both endogenous and exogenous learning resources across systemic levels. By analyzing the clumping patterns of excellence in STEM, the arts, sports, and innovation, the paper illustrates the unequal global distribution of talent-supportive environments. Seven key principles for effective resource orchestration are outlined, offering a framework for evaluating and strengthening national talent ecosystems. The paper concludes that systematic assessment and strategic enhancement of national resource landscapes are critical for sustainable talent development and for ensuring that human potential can flourish more equitably across countries.

Keywords: educational and learning capital; resource orchestration; systemic talent development; national talent support systems; excellence and equity; sustainable talent development

---

> Context matters in gifted education.
> Bruce M. Shore, 2021

1. Introduction

In recent years, the global competition for talent has intensified markedly, sometimes described as a "war for talent" (Michaels et al., 2001). At the same time, issues of educational equity and systemic barriers to excellence have gained international attention, emphasizing the urgent need for sustainable, evidence-based talent development strategies at the national level. In this context, understanding and enhancing the resource ecosystems that nurture human potential has become not just a matter of educational policy, but of national competitiveness and social cohesion.

In numerous publications in recent years, authors have described and analyzed how and how successfully individual countries support their talent (e.g., Alfaiz et al., 2022; Ayoub et al., 2022; Chandler, 2013; Dai & Kuo, 2017; Heller et al., 2000; Rindermann, 2018; Shavinina, 2009; Stoeger et al., 2018; VanTassel-Baska, 2013; Ziegler et al., 2018; Ziegler & Stoeger, 2023a). Such analyses can be extraordinarily effective and helpful in designing and delivering educational programs. Decisions made at upper system levels, for example, can potentially influence all subsystems and thus have a significant impact on educational outcomes. In contrast, individual initiatives and grassroots movements face significant challenges in achieving large-scale societal improvements (Fuszek et al., 2018; Nardini et al., 2021). However, the potentially high impact of decisions made at the upper suprasystem level also increases the risk that dysfunctional decisions can cause significant harm.

 doi:10.20944/preprints202504.2268.v1

Hence, national talent support policies must be carefully considered and strategically planned. They require accurate assessments of the current situation and evidence-based know-how to design talent development strategies.

2. Holistic Perspective: Widening of the Individualistic Talent Concept

Analyses at the level of social suprasystems, such as nations, raise the question of the extent to which the available conceptual repertoire is suitable. The country studies cited above build on an individualistic concept of talent postulated by important pioneers such as Francis Galton (*1822, † 1911) in the United Kingdom, William Stern (*1871, † 1938) in Germany, Alfred Binet (*1857, † 1911) and Théodore Simon (*1873, † 1961) in France, and Lewis M. Terman (*1877, † 1956) and Leta Stetter Hollingworth (*1886, † 1939) in the United States (Binet & Simon, 1905; Galton, 1869/1979; Hollingworth, 1931; Stern, 1900; Terman, 1922). These researchers are directly or indirectly among the founders of personality psychology, which is primarily interested in interindividual differences (Spearman, 1961; Terman, 1925). In the early phase of talent research, the answer to what enabled some people to achieve exceptional performance was thus primarily sought within the person.

Although fruitful, this early individualistic tradition also introduced conceptual issues (Stoeger, 2009). For example, the dominance of a nativist perspective in the early phase of giftedness research was problematic for understanding the role of the environment. For example, the fact that excellence occurred more frequently in some families was predominantly regarded as evidence for the heritability of talent (Galton, 1869/1979). Today, however, it is recognized that such clusters of excellence can also be traced back to shared environments (Plomin & Hershberger, 1991; Plomin & Rende, 1991). Fortunately, however, a role was soon attributed to the environment (e.g., Hollingworth, 1926, 1931), and has become increasingly influential in the history of giftedness research (Scarr, 1981). For some time, the environment has been explicitly included in concepts of talent, as seen in the highly influential model by Tannenbaum (1983) and its numerous derivations (Fischer et al., 2021; Gagné, 2009; Heller et al., 2005).

Where the environment was not directly included in a talent conceptualization, at least one of three approaches was taken. In the simplest case, the authors clarified the relationship to the environment (e.g., Sternberg, 2005). Two further possibilities can be illustrated with Renzulli's (1986) three-ring conception of giftedness. Either supplementary theories on environments, such as the schoolwide enrichment model (Renzulli & Reis, 2010), are created, or direct extensions of the original model are made to include environmental components (Mönks, 1992).

After the turn of the millennium, the significance of the environment was already considered so high that Barab and Plucker (2002) posed the question: “Smart contexts or smart people?” Indeed, most contemporary models of giftedness assign an important role to the individual and the environment (Dai, 2024; Sternberg & Ambrose, 2020). However, the personal component is undeniably much more elaborate than the environmental component (e.g., Gagné, 2009; Mönks, 1992; Tannenbaum, 1983); only groups of people, such as teachers and peers, or settings, such as the parental home, are usually mentioned. However, their role is not always clear. Though parents, peers, and school are critical in developing talent, social contexts can also impair talent development (Shore, 2021). Therefore, country analyses need substantially more elaborate models of the environments of talents and their underlying mechanisms (Subotnik et al., 2011, 2019).

3. Introducing a Resource-Based Framework

While traditionally the question of talent identification and talent development was thought of for the individual (“Is this person talented?” or “What is the best way to help this talent?”), the systems and institutions in which an individual is embedded are now thought of more intensely. In their recent publication on Scotland’s educational policies, Sutherland and Reid (2023) expressed their concerns about insufficient support for talent development at the country level. In doing so, they are addressing problems of a systemic nature that go beyond individualistic approaches to talent

 doi:10.20944/preprints202504.2268.v1

(Sternberg & Ambrose, 2020). These fall short in country analyses of their talent support for at least four reasons related to concept, scope, pragmatics, and systemic effects.

3.1. Country Analyses Beyond Individual Approaches

3.1.1. Concept

Current concepts of particularly talent-promoting environments, such as "gifted environments" (Mirman, 2003), "smart contexts" (Barab & Plucker, 2002), and "talent hotbeds" (Coyle, 2009) argue convincingly that environmental and social contexts differ significantly in their potential to promote the development of excellence. Most scholars would probably agree. For example, attending the Meadowmount School of Music in Westport, New York, in the United States, which boasts alumni such as Joshua Bell, Yo-Yo Ma, Itzhak Perlman, and Pinchas Zuckerman, increases the likelihood of achieving excellence in music (Coyle, 2009). However, these environmental typologies have two problems. Firstly, they mainly refer to the immediate environment of the talent. Many social subsystems (e.g., media and economic systems), which can also influence talent development in a country, are not included and usually not mentioned. Secondly, they do not offer a viable concept that bridges individual talent development with different system levels from the family to the chronosystem (Bronfenbrenner, 1992). For example, Coyle (2009) identifies the three commonalities of talent hotbeds, namely, that they combine the three key elements of deep practice, ignition, and master coaching. However, it is unclear how these concepts relate to individual learning dispositions (e.g., motivation) and the macro-structural characteristics of systems (e.g., the positive learning and work culture inherent in Confucianism; see Phillipson et al., 2013).

3.1.2. Scope

Country analyses of their talent support naturally lead to specific areas of interest. However, a substantial portion of these cannot be covered based on current talent concepts. We will illustrate this with four examples.

Performance in international student assessments: In the PISA study of 2018, the Republic of Singapore performed best of all countries in the three areas tested - reading, mathematics, and science - and, in particular, had the highest percentage of top performers (OECD, 2019).[1] The government would like to know whether its top performers will also perform excellently in 2040 or whether they should make timely modifications to the country's talent support system. Intuitively, many scholars would undoubtedly predict that the country will continue to perform excellently in 2040, but this intuition cannot be based on the concepts of giftedness and talent. For example, the immense motivation to learn of high-achieving students from Singapore would have to be considered. Many researchers attribute this to Confucian-influenced socialization (Phillipson et al., 2013). However, the national cultivation of this specific cultural resource goes beyond current conceptions of giftedness and talent.

Training of national teams: The leading nations at the International Mathematical Olympiads systematically train the members of their teams (Rindermann, 2011). The People's Republic of China is particularly successful, as its team has performed best at the last three Olympiads (IMO, 2024). Let us assume that country representatives would want to know how they can improve their nomination system, team training camps, and the selection and training of coaching teams in the future. So many issues come into play, such as social and infrastructural resources (Saul & Vaderlind, 2022), which are not systematically captured and elaborated on in talent concepts.

---

[1] In fact, a group of four PISA-participating provinces and municipalities of the People's Republic of China (Beijing, Shanghai, Jiangsu, and Zhejiang) performed better but do not represent the entire country.

 doi:10.20944/preprints202504.2268.v1

Non-academic field: In the Youth Olympic Games (YOG) history, East African 2000-meter steeplechasers have won all the gold medals and two-thirds of all medals (see results on worldathletics.org). It seems they can draw on an almost inexhaustible pool of talent. However, other countries are also trying hard to close the performance gap for East African runners. Let us assume that the East African countries are interested in whether they will continue producing many talented runners. The causal network is complex but contains multiple socio-cultural (Elbe et al., 2010; O'Connell, 1996) and infrastructural reasons (Thuany et al., 2023). A particularly striking example of an infrastructural influence stems from the underdeveloped school infrastructure in Kenya, where the average distances to the nearest school are comparatively large; however, this can be an advantage for developing walking skills. Onywera et al. (2006) report that a large proportion of successful athletes used to run to school every day (national athletes 73%, international athletes 81%). It has not yet been clarified how such deficient infrastructural resources, which positively impact talent development, can be integrated into talent models.

Equity: In the Middle East, gender parity in STEM (Science, Technology, Engineering, and Mathematics) subjects was achieved by 2016 (Islam, 2019), bucking a global trend (Nunez et al., 2023). Again, we could assume that Middle Eastern countries want to know how long it would take for this progress to become visible in international awards at the highest performance level. Specifically, they want to know whether their female STEM talents have the same chance as their male STEM talents of winning one of the three Nobel Prizes in science or the Fields Medal in mathematics within the next 20 years. Moreover, if not, what targeted measures could they take to increase their chances of achieving this? As with the previous examples, supplementary theories on current talent concepts are needed to answer this question.

3.1.3. Pragmatics

A country analysis of the effectiveness of talent development has the main objectives of description, explanation, and prediction (Stoeger et al., 2018). However, projection causes problems for talent conceptions if supplemental theories do not support them. For example, to answer the question raised above about the probability of Middle Easterners winning one of the three Nobel Prizes in the natural sciences or the Fields Medal in mathematics within the next 20 years, all individuals would have to be tested individually based on current talent conceptions and independent individual predictions would have to be made. Their probabilities must be added to form a country's talent development profile. Such a procedure would, of course, not be possible in practice.[2]

3.1.4. Systemic Effects

One of the key statements of systems theory is that different system levels, their dynamic structures, and their interaction must be analyzed to answer complex questions (von Bertalanffy, 1975). In this view, the whole (in this case, the talent development of a country) is always greater than the sum of its parts. Interactive effects include, for example, the correspondence and filter-empowerment heuristics found by Stoeger et al. (2022). A filter (denoting obstacles, social barriers, etc.) can prevent talent from accessing specific learning opportunities and resources in the talent support system. Conversely, it can also be the case that the talent development system actively transports various resources preferentially to some talents and thus empowers them. Different systemic processes of "talent denied" and social favoritism of talents in access to learning opportunities and providing learning resources underlie the numerous equity and excellence gaps (Ziegler & Stoeger, 2023b).

---

[2] It is important to acknowledge that, conversely, relying solely on environmental analyses to make a reasonably reliable forecast in a country without conceptual tools for addressing individual talents is equally idealistic.

 doi:10.20944/preprints202504.2268.v1

Furthermore, nations are highly complex systems that – by their very nature as systems – have mechanisms to maintain structures even when their elements are replaced. For example, when a gifted educator or a teacher retires, other people fill their positions. It is similar to talent. When the talented students in a country's sixth grade move up to the seventh grade, a new cohort of talent moves in. From a systemic perspective, individually-oriented concepts of giftedness and talent must also be augmented by supplementary theories that can capture systemic effects.

3.2. Insights from Clumping for Developing a Bridging Concept between Talent and Country

Clumping patterns observed in the distribution of peak performances across countries offer important insights into the systemic factors that support or hinder talent development. Rather than being random, these concentrations suggest that certain environmental, social, and infrastructural conditions systematically foster excellence. Learning from these patterns provides a natural foundation for constructing a bridging concept that connects individual talent development with national-level systemic dynamics.

A conceptual bridge that has the potential to connect systemic levels from an individual to social macrosystems could be 'resources'. They are, by definition, means that can be used to achieve an end. In this case, we are concerned with all resources that can be used to promote talent in a country. These resources have one interesting feature in common with extraordinary accomplishments: they both occur in clumps, that is, where there are many resources, there is an increase in exceptional achievements, which are, in turn, clumped.

Distribution patterns describe the distribution of things, individuals, entities, and so on in space at a given time. Theoretically, three main types of distribution are conceivable: random, uniform, and clumped. Resources essential for talent development are clumped (Ziegler et al., 2017). The clumps can be analyzed from different perspectives, including social, cultural, and, most importantly, spatial.

Even if a society has manifold resources for talent development, this does not imply equal accessibility. Resources cluster strikingly around social groups and entities, including social class, race, gender, country, and so on. This results in numerous equity and excellence gaps (Plucker & Peters, 2016). For example, many disturbing excellence gaps are reported on the homepage of the Nobel Prize committee at the time of writing (Nobel Prize Committee, 2024). In terms of resources, the many resource disadvantages of Black people (Nasir et al., 2020) translate early on (Long et al., 2023) into the phenomenon of talent denied (Ziegler & Stoeger, 2023b). As adults, therefore, it is challenging for them to achieve excellence. Of the total 954 Nobel Prizes awarded, Black people received only four Nobel Prizes in Literature, twelve Nobel Peace Prizes, and only one Nobel Memorial Prize in Economics. No one received the award in the STEMM fields of physics, chemistry, physiology, or medicine.

Resources may also cluster culturally. An oft-cited example is the educational advantage of Asian Americans in terms of academic achievement (Sue & Okazaki, 1990). Research has found that this advantage is mainly due to their more significant academic effort, which is strongly related to cultural factors. For example, they have much stronger beliefs regarding the connection between effort and achievement (Hsin & Xie, 2014).

Resources for talent development also cluster spatially, for example, in settings, infrastructures, and countries. Books are concentrated in libraries, while far above-average learning opportunities are concentrated in schools and universities. The instance of universities also shows that there are further clusters (e.g., by country) within the clusters (universities). After Alexa Internet (2024), the QS World University Rankings are the most frequently considered worldwide. A total of 1418 institutions from over 100 regions were included in the 2023 rankings (QS Top Universities, 2024). Overall, only universities from 22 countries were represented in the top 100. The top 10 included five American and four British universities. More than half of the top 100 universities were from just three countries: the United States, the United Kingdom, and Australia.

3.3. The Clumping of Peak Performance Across Countries

 doi:10.20944/preprints202504.2268.v1

Banks (1997) described the neglect of the way talent is distributed as "intellectually embarrassing." He was primarily interested in the Golden Ages. A Golden Age is a period in which markedly high achievements were made, particularly in the arts, and the geographically concentrated occurrence of excellence (Collins Dictionary, 2024). Banks pointed out that these incredible accumulations almost rule out random patterns in the distribution of talent. This leaves only two other fundamental dispersion patterns: an aggregate pattern, in which individuals appear clumped, and a uniform pattern, in which individuals are uniformly distributed (Britannica, 2024). However, glancing at the distribution of peak performances in the various fields will suffice. Wherever we look, there are clumps without exception. Our focus is on the distribution of talent in countries at present. To do this, we first look at representative indicators of talent. We have tried to ensure that the overview is as broad as possible, not only in terms of subject but also of the indicators used (e.g., selection of committees, direct competitions, or objective measures such as number of citations or patent grants).

3.3.1. STEM

The United Nations is currently made up of 193 Member States. Only 32 countries have received at least one Nobel Prize for 'hard science' (chemistry, physics, physiology, or medicine). Among these nations, the gaps are incredibly high. For example, per 100 million inhabitants, India (0.1), China (0.3), and Pakistan (0.4) have received the fewest Nobel Prizes, while Switzerland (227.9), Denmark (171.4), and Austria (132.3) have received the most (Areppim, 2024a). The Fields Medal, the most prestigious mathematics award, has been awarded to people from only 22 countries. Once again, the range among the prize-winning nations is considerable. At the same time, China received 0.1, Brazil 0.5, and Vietnam 1.0 medals per 100 million capita, New Zealand 20.4, France 19.8, and Norway 18.1 (Areppim, 2024b). The Turing Award, awarded since 1966 and often addressed as the "Nobel Prize of Computing" (Dasgupta et al., 2008, p. 137), is one of the most extreme examples of clumping in a single country. Of the 77 awards conferred, 49 or 63.2 %, went to citizens of the United States (ACM, 2024).

3.3.2. Social Sciences and Humanities

Research.com (2023) published a ranking of the D-index (discipline H-index) at the end of 2022 of scientists who published in the social sciences and humanities. The 100 top-cited scientists worked at institutions in only 17 countries, more than half in the USA (53). A total of 71% worked in the top three nations: in addition to the United States, these included two other countries with English as an officially recognized language, namely the United Kingdom and Canada.

3.3.3. Arts

Impressive historical examples of national clusters in the arts are the Golden Ages (Banks, 1997). Well-known examples are the Spanish Golden Age from the late 16th to the early 17th century. Famous painters of this period include El Greco (1541-1614), Diego Velázquez (1599-1660), and Bartolomé Esteban Murillo (1617-1682). It included the "Siglo de Oro" (Golden Century; approx. 1550 to 1680). Famous writers were Miguel de Cervantes (1547-1616), Lope de Vega (1562-1635), and Pedro Calderón de la Barca (1600-1681). It overlapped with the Dutch Golden Age, roughly spanning the 17th century. Immortal painters such as Rembrandt van Rijn (1606-1669), Johannes Vermeer (1632-1675), Frans Hals (1582-1666), and Pieter Bruegel the Elder (ca. 1525-1569) created works during this period. The golden age of art in the small city-state of Florence also shines with immortal names such as Filippo Brunelleschi (1377-1446), Donatello (ca. 1386-1466), Sandro Botticelli (1445-1510), Leonardo da Vinci (1452-1519) and Michelangelo Buonarroti (1475-1564).

Numerous national clusters in art can also be found in the modern era. Perhaps the most important art prize is the Nobel Prize for Literature. The 119 Nobel Prizes awarded to date have gone to authors from only 41 former or current countries. In absolute terms, the three top nations, France

 doi:10.20944/preprints202504.2268.v1

with 16, the United States with 13, and the United Kingdom with 12 prizewinners, accounted for more than a third of all winners. However, when looking at winners per 100 million capita, Ireland with 79.9, Sweden with 78.8, and Norway with 54.4 were particularly successful among the countries where at least three authors received a Nobel Prize. Many other art statistics show similar skewed distributions. If we look at pop music, for example, a more modern art form, the statistics for the top-selling artists worldwide as of August 2022 only include singers and groups from English-speaking countries in the top 20 (Statista, 2024).

3.3.4. Sport

According to the World Atlas (2024), soccer is the most popular sport in the world. There are 211 national associations represented in FIFA soccer. The FIFA World Cup (Men's) is played every four years. Of the 22 World Cups, the four countries, Brazil, Germany, Italy, and Argentina, have won 15.

The largest multi-sport event in the world is the Summer and Winter Olympic Games, held every four years. To date, 156 current and historic National Olympic Committees have won one of the 20281 gold, silver, and bronze medals, while 68 of the current 206 National Olympic Committees have never done so. ("All-time Olympic Games medal table," 2024). In the 29 Summer Games held, the United States was the most successful nation 18 times, followed by the Soviet Union, which topped the rankings six times. In the 25 Winter Games, Norway and the Soviet Union (including Russia) were the most successful teams, with nine medals each.

3.3.5. Vocational Skills

WorldSkills International operates in 86 countries and regions (WorldSkills, 2024a). It hosts a world championship every two years, addressing around 50 trades in construction and building technology, creative arts and fashion, information and communication technology, manufacturing and engineering technology, social and personal services, and transportation and logistics. One hundred seventy-six gold medals have been awarded at the four world championships since 2015 (WorldSkills, 2024b). Of these, the four nations, China, Taiwan, South Korea, and Russia, received three-quarters of the gold medals, totaling 132.

3.3.6. Intellectual Property Indicators

The "World Intellectual Property Indicators 2021" report (WIPO, 2021), published by the World Intellectual Property Organization (WIPO) of the United Nations, provides statistics on intellectual property filings. Of the more than 3 million patents, 72.7% went to the three top nations: China, the United States, and Japan; of the utility models, 98.3% went to the three top nations China, Germany, and Russia; of the trademarks, 62.6% went to the three top nations China, the United States and Iran.

3.3.7. Interim Summary

The anecdotal literature review clearly shows that neither the resources required for talent development nor peak performance are equally or normally distributed. Simonton (2003) explained such clumps through different cultural, social, political, and economic circumstances "[...] that determine the extent to which the resulting milieu nurtures the development of creative potential and the expression of that developed potential" (p. 304). Many of the clumps reported above appear to be the result and echo of an educational reality that accompanied the Industrial Revolution that began to unfold at different times in the world's countries. At that time, educational resources were still concentrated in a few primarily rich Western countries, which led the way economically and needed a highly qualified workforce. However, from "West leads East," we are now more at an inflection point of "West meets East" (Chen & Miller, 2010; Tung, 2023). After the Second World War, the world witnessed an educational explosion that changed its educational profile. Many of the reported statistics on national clumps and the improvements of nations in their educational outcomes

 doi:10.20944/preprints202504.2268.v1

over the last hundred years correspond surprisingly well to various indices of the global distribution of educational resources (Eberstadt & Abramsky, 2022).

Such findings on clumping align with Ziegler and Stoeger's (2023a) dictum that talent in a country is a function of the available resources and opportunities for talent development. Unfortunately, few studies have tested this thesis in country analyses. However, the results consistently show that a resource-oriented approach is fruitful (Al-Hroub, 2022; Bakhiet & Mohamed, 2022; Ismail et al., 2022; Zhao, 2021). In particular, these studies show two things, namely that a resource-oriented approach can explain both the effectiveness of national talent development and clusters of peak performance in a country. It, therefore, appears natural to systematically elaborate such an approach so that comparative country analyses are also possible. In the following, we will be following the Educational and Learning Capital Approach (ELCA) developed by Stoeger, Vialle, and Ziegler (Stoeger et al., 2017; Vialle & Stoeger, 2018; Ziegler et al., 2017; Ziegler & Baker, 2013; Ziegler & Stoeger, 2023a).

3.4. Educational and Learning Capital Approach

In a country analysis, the valuable individualistic perspective of identifying optimal learning pathways must be expanded with a systemic perspective considering exogenous factors in the talents' environment. The reason for this is that the country analysis does not make a statement about individual talent. Rather, what is of interest is the probability that a country as a whole will produce talent and how it can increase this probability by making better use of existing resources and building up new resources.

Though the focus of interest is on how well a nation supports talent development, the analysis must be much broader than just the system level of the country. Technically speaking, it aims to evaluate a complex polyhierarchical system at all levels. It also includes: a) subsystems relevant to talent development, b) relationships of the country and its subsystems with other systems, and c) relationships of the country and its subsystems with suprasystems. The key question is what needs to be considered in the systemic analysis. The ELCA offers a conceptual framework to answer this question and is based on the actiotope model of giftedness, which suggests that talent development depends on the individual's actiotope, which encompasses the individual's characteristics and behavior as well as the segment of the material, social, and informational (learning-)environment with which he or she interacts (Ziegler & Baker, 2013; Ziegler, Stoeger et al., 2017). Within this actiotope, potentially facilitating factors for successful talent development are viewed as (learning) resources.

The ELCA distinguishes five endogenous and five exogenous resources, that is, resources localized in the individual or their environment. These are termed 'learning capital' and 'educational capital'. To provide an overview, Table 1 summarizes the definitions and illustrative examples of the five types of educational capital and the five types of learning capital. The ELCA maintains that "wherever there are sufficient resources, the effective orchestration of those resources will lead to talent development" (Ziegler & Vialle, 2024). Therefore, resources and their effective orchestration must be analyzed in country analyses.

Table 1. Descriptions and Illustrative Examples of Educational and Learning Capital Types Based on the Educational and Learning Capital Approach (ELCA).

Capital	Description	Examples
	Exogenous Resources (Educational Capital)	
Economic educational capital	Wealth, possessions, or financial resources that can be invested in talent development	Funding private tutoring; buying educational technology (laptops, lab equipment); financing participation in summer academies

 doi:10.20944/preprints202504.2268.v1

Cultural educational capital	Value systems, norms, and goals promoting talent	Parental emphasis on education; societal norms valuing intellectual achievement; cultural belief in effort over innate ability
Social educational capital	Support from individuals and institutions	Mentorship by experienced teachers; access to professional networks (e.g., science clubs); peer encouragement to pursue STEM fields
Infrastructural educational capital	Materially implemented opportunities	Well-equipped laboratories in schools; access to public libraries and museums; regional talent development centers
Didactic educational capital	Pedagogical expertise and learning guidance	Individualized learning plans by teachers; high-quality feedback mechanisms (e.g., formative assessment); structured coaching programs for competitions
Endogenous Resources (Learning Capital)		
Organismic learning capital	Physiological and constitutional resources	Good physical health; fitness; healthy sleep and nutrition habits
Telic learning capital	Goals, ambitions, and emotional evaluations guiding action	Long-term career ambitions (e.g., becoming a scientist); feeling excitement when facing complex learning challenges; sense of belonging in a learning community
Actional learning capital	Repertoire of actions and skills	Mastery of effective study strategies; self-regulated learning skills; expertise in domain-specific skills (e.g., solving advanced math problems)
Episodic learning capital	Experiences and know-how	Building academic confidence through small cumulative successes in challenging subjects; knowing from past experiences which learning strategies work best for oneself; having developed intuitive judgments about when to persist, seek help, or change learning tactics based on previous successes and failures
Attentional learning capital	Focused attention and time resources	Ability to maintain long periods of focused study; skillful time management across academic and personal life; effective handling of distractions during learning activities

Talent development is embedded in the immediate context of a situation and, therefore, in higher-level systems such as families, schools, talent centers, and nations. In ELCA terminology, all of these higher-level systems may provide exogenous resources that can be used to promote talent. These are called educational capital (Ziegler & Baker, 2013). Educational capital can take on positive values if it encourages talent development and negative values if it prevents talent development.

Economic educational capital plays a particular role, as financial and material resources cannot directly promote talent. Therefore, economic educational capital is a proto-capital, as it must first be converted into one of the other educational capitals before it can be used in talent support (e.g., buying learning materials, building schools, hiring tutors).

Exogenous resources can be analyzed at all system levels up to that of the nation. Parents at home, teachers at school, the media, and politicians with their decisions in parliaments, to name just a few societal sub-systems, can all promote talent (social educational capital). Both at home and at school, learning opportunities are created and learning materials are made available (infrastructural educational capital). Learning and talent development are valued at home, school, media, and

 doi:10.20944/preprints202504.2268.v1

parliaments (cultural educational capital). Parents and teachers have specific pedagogical skills, and the national school curriculum does not consider the unique learning needs of talents (didactic educational capital).

While educational capital refers to the exogenous resources embedded in a talent's environment, the successful utilization of these resources depends critically on internal resources within the individual. The ELCA conceptualizes these internal enablers as learning capital. Together, educational and learning capitals form the resource ecosystem that drives sustainable talent development.

The ELCA also stipulates five types of endogenous resources called learning capitals. Organismic learning capital plays a pivotal role as a proto-capital, providing the physiological and constitutional foundation from which other forms of learning capital can be developed. For example, learning can be more effective in a resting state, but a talented person could also pursue some leisure activities during the rested state and allow the time favorable for learning to pass unused.

The ELCA assumes that these endogenous resources are necessary to use the exogenous resources for talent development (Ziegler et al., 2017). For example, suppose a talent is unmotivated or does not have the required basic knowledge to understand a learning unit (lack of telic and actional learning capital). In that case, it does not matter how well a teacher delivers a lesson at school (didactic educational capital); the learning is not successful.

The critical challenge for national talent development systems is not merely the provision of individual resources, but the effective orchestration of educational and learning capitals across diverse systemic levels. To address this, the following section outlines seven key principles that guide how resources can be mobilized, integrated, and optimized to foster sustainable excellence.

3.5. Seven Principles for the Systemic Orchestration of Talent Development Resources

Talent development towards excellence is only possible if sufficient educational and learning capital is available. However, only in their interaction does each capital unfold its full effect (Ziegler & Phillipson, 2012; Ziegler & Stoeger, 2017). An excellent curriculum (didactic educational capital) is of little use without competent teachers (social educational capital) to implement it. Conversely, the most dedicated teachers will work in vain if they do not have the specific knowledge to promote talent' learning. Many talented individuals from historically disadvantaged groups will set their ambitions too low (telic learning capital) without the necessary cultural educational capital surrounding them (Ziegler & Stoeger, 2023b). Likewise, the proto-capitals must be available. For example, even outstanding golf talents with impressive actional and episodic learning capital will be unable to reach their full potential if they cannot raise the necessary economic educational capital to hire a personal coach (Portenga, 2019). Therefore, country analyses of talent support systems must consider the effective orchestration of resources so that learning pathways to excellence are made possible.

To systematically assess how effectively a country's resources support talent development, we propose seven key principles that guide the orchestration of educational and learning capital. These principles help identify strengths, weaknesses, and interaction patterns in talent support systems. In the following, we briefly describe each principle: the Law of the Minimum, the Principle of Compensation, the Principle of Continuity, the Principle of Polytely, the Principle of Accessibility, the Principle of Free Resource Flow, and the Principle of the Megatopes.

3.5.1. Law of the Minimum

Since all resources are necessary according to the ELCA, the law of the minimum applies. It states that the weakest resource limits the potential for the development of a system (Salisbury, 1992). Overcoming the law of the minimum is a significant challenge for countries and is usually only successful in individual domains in which a country has specialized. In this scenario, however, a country may produce an extraordinary number of top performers.

 doi:10.20944/preprints202504.2268.v1

Striking examples can be found in winter sports and music-loving Austria. The small town of Kitzbühel in Austria has approximately 8,000 people. A perusal of the town's famous sons and daughters reveals an impressive 24 listed world-famous winter sports stars (Kitzbühel, 2024). In contrast, only two famous musicians are listed for Kitzbühel, including Aufschnaiter, a composer from the 17th century. Winter sports enthusiasts benefit from an almost perfect range of resources, which seems to have no weak points. The town's primary source of income is ski tourism, the proceeds of which are continuously used to improve the infrastructure. There are now 234 kilometers of slopes. Without snowfall, it is still possible to train on summer slopes and artificial snow slopes all year round, including at night under floodlights. Several ski schools with outstanding trainers take care of the local youngsters from an early age. Use of the practice lifts is free of charge. Considering all of these available resources, Kitzbühel is an example of a megatope, a system with very high support for talent development and outstanding outcomes (Ziegler & Stoeger, 2023a). Conversely, the Mozart city of Salzburg has also built up an almost perfect resource profile in music.

Salzburg, which has a population of 150,000, generously supports orchestras, ensembles, choirs, events such as the Salzburg Festival, and musical institutions such as the Mozarteum University Salzburg. The list of world-famous personalities who have worked in the city includes eleven winter sports stars. However, there are 54 renowned musicians and, interestingly, half a dozen outstanding people who are indirectly involved in music (e.g., music critics and instrument makers) (List of personalities of Salzburg, 2024). Comparable clusters of resources and top performers cannot be found in any other Austrian region or domain, such as mathematics or electrical engineering.

3.5.2. Principle of Compensation

The rare exceptions are megatopes such as Kitzbühel in winter sports and Salzburg in music with a perfect resource profile. As a rule, resources are lacking or are suboptimal compared to other resources, thus limiting their effectiveness. However, it is often possible to compensate for resource deficits. For example, homeschooling is a common and very effective practice in Canada to support gifted students when the school can no longer meet their learning needs (Hood, 2012). However, such compensation is impossible in countries like Germany, as homeschooling is prohibited there.

Numerous subsystems specialize in compensating for deficits in the talent development of other subsystems. For example, enrichment programs for the gifted are typically designed to supplement and deepen school curricula and promote thinking skills and creativity (Kim, 2016).

3.5.3. Principle of Continuity

The principle of path dependency characterizes talent development, that is, the following learning step depends on the previous states or decisions. Every support measure for talents must be tailored to their current learning needs. For example, enrichment at kindergarten and further enrichment during primary school are insufficient if the talent does not receive any support in the times between those offerings.

Several subsystems manifest the continuity principle, and their contribution can vary significantly at different times (Stoeger et al., 2024). At the beginning of talent development, the family subsystem often plays a more significant role, while increasingly specialized persons and institutions lead to professionalization in later stages. Hence, it must be ensured that there is an uninterrupted learning pathway to excellence and not just a series of disconnected, isolated support measures.

3.5.4. Principle of Polytely

Biographical analyses reveal many possible pathways in all domains that fully utilize individual talent and excellence (Csikszentmihalyi, 1996; Goertzel & Goertzel, 1962; Vialle, 2013). According to the ELCA, each talent finds a particular constellation of resources in their actiotope (Ziegler & Baker,

 doi:10.20944/preprints202504.2268.v1

2013). Thus, the more potential trajectories a country can provide for talent development in a domain, the greater the likelihood that talents can access the most suitable learning pathway.

3.5.5. Principle of Accessibility

The likelihood of developing one's talent is still linked to group memberships, such as gender, race, and socioeconomic status (Peters, 2022). These groups have varying access to resources (Ziegler & Stoeger, 2023b). A country analysis of the talent support system must thus go beyond questions of resource availability and also analyze its accessibility for talent. Otherwise, a country's talent pool is restricted to privileged talents.

3.5.6. Intellectual Property Indicators

Whether resources reach the actiotopes of the talents can be analyzed from the perspective of the talents, as in the principle of accessibility. However, this perspective must be complemented by analyzing the flow of resources through the environmental systems to the actiotopes (Ziegler et al., 2023). Using the example of the filter-empowerment heuristic, Stoeger et al. (2022) demonstrated empirically that there are more likely resource trajectories ("empowerment") or less likely ("filter") to allow resources to enter the actiotopes of talents. These probabilities are often linked to the group memberships of talents mentioned above.

3.5.7. Principle of the Megatopes

Several talent development models include a chance component (Dai, 2024; Gagné, 2009; Tannenbaum, 1983). Many biographical analyses and expert studies reveal how unpredictable talent development and the acquisition of excellence are (Csikszentmihalyi, 1996; Ericsson et al., 2006; Paik et al., 2018, 2021; Subotnik et al., 2019). It is difficult for a country to reliably ensure that the functional resources are available at every stage of talent development. In a megatope (and to a lesser extent in a polytope or eutope; for details, see Ziegler & Stoeger, 2023a), however, chance is reduced by availability, accessibility, and free resource flow. This can be seen in the examples mentioned of Kitzbühel in winter sports or Salzburg with music. These are highly specialized subsystems, like the art and craft workshops in Florence, elite universities in the United States, the chess schools of the former Soviet Union, and the Singapore school system, that reliably produce far above-average performance. To a considerable degree, they provide an extensive, rich repertoire of resources that offer all those with access to these resource clusters a far above-average opportunity to achieve excellence. Such near perfection in the effective orchestration of resource centers is a strong predictor of excellence in a country and should be given special consideration in any country analysis.

4. Discussion

People differ considerably in their opportunities and probabilities of achieving eminence. Our brief overview of the international distribution of top performers indicates that the resources available and accessible in the country where they grew up are significant factors contributing to this distribution. At the same time, there has been increasing competition for talent and top performers worldwide in recent years. To describe this trend, Steven Hankin of McKinsey & Company coined the rather martial term "War for Talent" (Michaels et al., 2001). Talent is now recognized in most countries as a precious group needing support and promotion (Rindermann, 2018; Stoeger et al., 2018). This trend is also reflected in the many country analyses of talent support systems published in recent years (e.g., Chandler, 2013; Dai & Kuo, 2017; VanTassel-Baska, 2013; Ziegler & Stoeger, 2023a).

However, country analyses based on traditional concepts of talent quickly reach their limits, as it is impossible to bridge personal systems to macrosystems solely based on individualistic concepts. It has been suggested, therefore, that country analyses be carried out based on the ELCA. However, this raises three significant issues we want to address in this discussion: (1) Can the ELCA function

 doi:10.20944/preprints202504.2268.v1

as a bridging theory between individual talent and national talent development? (2) Researchers who adopt the ELCA as a basis for country analyses of national talent development systems probably would not abandon their conception of talent, thus raising the question of the extent to which the ELCA can be combined with other talent concepts. (3) Finally, we want to ask self-critically if the application of the ELCA generates new problems of its own that outweigh its supposed advantages.

4.1. Bridging Theory

The necessity of going beyond the individual to understand the complex processes of talent development and optimal talent development is already recognized in many talent concepts that focus on the individual (Sternberg & Ambrose, 2020). The necessity to broaden the focus becomes all the more significant if the role of the context is to be analyzed from the actiotope to the nation (Ziegler & Stoeger, 2023a). There are three fundamental theoretical possibilities here, of which the ELCA has opted for the last.

Firstly, one could still hope that established individual-oriented theories of talent might provide the necessary repertoire of concepts. In this respect, the most progressive and exciting concept was recently presented by Sternberg (2023), who postulates a three-way interaction of a person x task x situation. The two-fold extension of the person to include task and situation promises a much more potent link between talent and situational behavior. Nevertheless, the conceptual distance between talent and a nation's talent development is too gigantic to be bridged by concepts such as task and situation. Therefore, a second possibility would be combining an established talent conception with a potent environmental theory. Unfortunately, such an environmental theory does not yet exist. Existing concepts (e.g., “gifted environments” (Mirman, 2003) or “talent hotbeds” (Coyle, 2009)) are not elaborated sufficiently and do not extend far enough to be linked to talent development at the country level.

A third way would be a mediating concept bridging the gap between the personal and macrosystem. Such a concept could be resources, as they are localized as endogenous resources in talents and exogenous resources at each system level, according to the ELCA. In addition to theoretical soundness, the third way would fulfill other characteristics usually required of good theories, especially parsimony and consistency (Gieseler et al., 2019; Harding, 1975). In addition, the concept of resources offers an exhaustive classification scheme based on its openness (Vialle, 2013). By implication, however, concerning resources, this means that the analysis of a country's talent development is incomplete if one of the capitals of the ELCA is neglected.

Due to these advantages of bridging concepts, a proliferation of competing concepts would be welcome. Potential alternative candidates to the concept of resources would be, for example, goal setting (Siegert & Levack, 2014) and communication (Luhmann, 1995). They would undoubtedly fulfill criteria such as parsimony and consistency. On the other hand, evidence of exhaustivity and theoretical soundness would still have to be provided.

4.2. Combinability with talent concepts

Realistically, it is expected that those who work with a preferred talent model in the research and support of talent will also favor this model in country analyses. This raises the question of whether the ELCA can be combined or interconnected with other talent concepts and whether it yields additional benefits for them. In essence, it is about the commensurability of theories (Sady, 2021). However, we must concede that our analysis cannot be complete due to the overwhelming number of talent concepts. Alghawi (2015) cited a figure of over 200 talent concepts in 2015, and that count continues to rise.

The problem of commensurability is somewhat different for the endogenous and exogenous resources postulated in the ELCA. At first glance, the commensurability of the former appears more critical, as all talent concepts - in the terminology of the ELCA - make explicit statements about the endogenous resources of talents without exception. They identify these in a high IQ, for example, or, as in the three-ring conception, in above-average task commitment, cognitive abilities, and creativity

 doi:10.20944/preprints202504.2268.v1

(Renzulli, 1986). Superficially, potential contradictions can therefore arise. However, this skepticism ignores a fundamental difference between a talent concept and a classification scheme such as the ELCA. The latter is not a theory but a method for structuring and organizing information to make it more accessible and understandable. Since the ELCA is exhaustive (Vialle, 2013), there are two prototypical possibilities from the perspective of any talent concept.

Firstly, it may be the case that one of the learning capitals or manifestations of learning capital (e.g., organismic capital by health, physical fitness, restful sleep) has no direct equivalent in a talent conception. For example, organismic learning capital is not a component of Renzulli's (1986) three-ring conception of giftedness. On the other hand, Gagné (2020) has continuously expanded his model based on empirical findings and has added physical traits as catalysts to his DMGT (Differentiating Model of Giftedness and Talent). However, even if a learning resource is not directly included in a talent conception, this does not mean that it cannot become significant as a boundary condition. For example, above-average cognitive abilities are a central concept in Renzulli's model. As it is well known, poor or insufficient sleep decreases the cognitive capacity of children and adults (see Gruber et al., 2013). We, therefore, consider it possible that there is a potential for either the inclusion of the endogenous variables of the ELCA into talent conceptions or viewing them as boundary conditions when performing country analyses.

Secondly, talent concepts can also refer to capital manifestations, that is, similar empirical findings. For example, telic learning capital addresses a person's goal system, including evaluating possible states. Psychological manifestations of this learning capital include all goal-related emotions, preferences, and motivational orientations. Such emotional and motivational constructs are directly integrated into almost all talent concepts or are at least considered relevant. This also applies to manifestations of the other capitals, such as episodic learning capital (such as the amount of deliberate practice and positive experiences), actional learning capital (such as learning strategies and self-regulatory skills), and attentional learning capital (such as time resources and concentration). It is crucial for commensurability that the ELCA does not make any specifications at the level of endogenous resources. Whether Dweck's (Dweck & Yeager, 2019) or Elliott's (2020) approach prevails as a theory of motivational orientation, for example, is of secondary importance from the ELCA's point of view. According to the ELCA, the talent concept must consider a manifestation of telic capital to enable compatibility. If it does not, its country analysis will not be complete from the ELCA's point of view due to its exhaustiveness, as mentioned above.

Educational capital can be combined with talent conceptions, similar to learning capital. To our knowledge, no talent conception fails to recognize, in one way or another, the importance of social educational capital (teachers, parents, coaches, etc.), cultural educational capital (values, norms, incentives, etc.), infrastructural educational capital (schools, libraries, training routes, etc.) and didactic educational capital (curriculum, feedback scheme, training schedules, etc.) for talent development, at least as a boundary condition. There also seems to be no objection to connecting to the proto-capital of economic educational capital after it has been translated into one of the other educational capitals. Furthermore, we are unaware of any objections as to why talent models could not be combined with the concept of resources. In fact, in the country analyses cited above, the concept of resources was used without any problems by authors who usually prefer individualistic conceptions of talent.

4.2. Application of the ELCA

One advantage of the resources postulated in the ELCA is that they bridge individual talent theories and macro-structural societal analyses based on the two types of capitals and their interactions (Vialle & Ziegler, 2017; Ziegler et al., 2018). This makes it possible, for example, to map inconsistencies and stagnation in the flow of capital between different systemic levels, such as the effect of filters described above (Stoeger et al., 2022). However, such analyses quickly reach a level of complexity - especially when entire countries are analyzed - that can easily exceed research capacities. As the road to a coherent theory of resource orchestration is long, it remains to be seen whether the

 doi:10.20944/preprints202504.2268.v1

ELCA will prove its effectiveness. The fact that it has already been used successfully in various country analyses lends cautious optimism (Al Hroub, 2022, 2023; Alfaiz et all, 2022; Alsalah & Tazi, 2023; Ayoub et al., 2022; Bakhiet & Mohamed, 2022; Chacón Soto, 2024; Irueste et al., 2024; Gomez-Arizaga et al., 2024; Hafsyan, 2023; Hemdan, 2022; Ismail et al., 2022; Muglia Wechsler et al., 2024; Vuyk et al., 2024; Zhao, 2021).

5. Outlook

Finally, we would like to briefly discuss whether learning resources and, thus, top performance will continue to be distributed unequally in the future, as we have seen in our cursory country overview. Until now, the Western world (Australia, Canada, New Zealand, United States, Europe except Turkey and the former Eastern Europe) and East Asian countries have dominated. On average, these countries have significantly more developed economies (Paprotny, 2021; Popov, 2009). This allows the continuous flow of proto-capital (economic educational capital), which can be converted into other educational capital types. This process began in most of today's industrialized countries in the mid-19th century. However, due to the general growth of the global economy, more and more countries are succeeding in this today, as the monumental work by Lee and Lee (2016) shows (see also Roser, 2024; Roser & Ortiz-Ospina, 2024). The authors analyze the human capital stock from 1870 to 2010 and note a worldwide increase. In the view of the ELCA, more and more people worldwide benefit from educational capital. Interestingly, developed countries appear to have reached a tipping point regarding financial investment. In line with this observation, the OECD (2012) stated that "the amount spent on education is less important than how those resources are used" (p. 1).

As the know-how for optimal talent support and the optimal use of learning resources is now reaching national talent development systems more and more effectively, primarily through open access to information, we can expect to see an increasing improvement in talent development worldwide. Multiple efforts to promote talent effectively in almost all countries reinforce this presumed trend (Ziegler et al., 2018). However, sustainable talent development demands a deep understanding of the complex resource landscapes within nations. By identifying resource strengths, addressing systemic gaps, and optimizing the orchestration of resources at all systemic levels, countries can secure sustainable national excellence and also contribute to a fairer global distribution of opportunities for human potential to flourish.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used: “Conceptualization, A.Z., writing—original draft preparation, A.Z., N. N-S., writing—review and editing, A.Z., N. N-S., W.V., H.S.; supervision, W.V., H.S.; project administration, A.Z., H.S. All authors have read and agreed to the published version of the manuscript.”

Funding: This research received no external funding.

Acknowledgments: The authors would like to thank Mehmet Bicakci and the participants of the American-European Summits on Talent Development 2023 in Haifa and 2025 in Berkeley for discussing the ideas in this article.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviation is used in this manuscript:

ELCA	Educational and Learning Capital Multidisciplinary Digital Publishing Institute

 doi:10.20944/preprints202504.2268.v1

References

1. ACM (2024, Sep 04). *ACM award recipients*. Retrieved from https://awards.acm.org/award_winners?year=&award=140&region=&submit=Submit&isSpecialCategory=
2. Al-Hroub, A. (2022). Gifted education in Lebanon: Re-examining the role of educational and learning capitals. *Cogent Education, 9*(1), 2073644. https://doi.org/10.1080/2331186X.2022.2073644
3. Al-Hroub, A. (2023). Evaluating gifted education in Palestine: A study of educational and learning capitals. *Cogent Education, 10*(2), 2240931. https://doi.org/10.1080/2331186X.2023.2240931
4. Alexa Internet (2024, Sep 04). *Top universities*. Retrieved from https://web.archive.org/web/20200728174448/
5. Alfaiz, F. S., Alfaid, A. A., & Aljughaiman, A. M. (2022). Current status of gifted education in Saudi Arabia. *Cogent Education, 9*(1), 2064585. https://doi.org/10.1080/2331186X.2022.2064585
6. Alghawi, M. (2015). *Needs assessment of gifted programs in Dubai* (Unpublished PhD thesis). Dubai, United Arab Emirates: The British University in Dubai.
7. All-time Olympic Games medal table (2024, Sep 04). In *Wikipedia*. https://en.wikipedia.org/wiki/All-time_Olympic_Games_medal_table
8. Alsalah, L., & Tazi, N. (2023). Gifted education in Morocco: An exploration via learning resources. *Cogent Education, 10*(2), 2228966. https://doi.org/10.1080/2331186X.2023.2228966
9. Areppim (2024a, Sep 04). *Nobel Prize Awards in Science per capita*. https://stats.areppim.com/stats/stats_nobelhierarchy_percapita.htm
10. Areppim (2024b, Sep 04). *Fields Medal for mathematics per capita, 1936-2022*. https://stats.areppim.com/stats/stats_fieldsxcapita.htm
11. Ayoub, A. E. A., Abdulla Alabbasi, A. M., & Morsy, A. (2022). Gifted education in Egypt: analyses from a learning-resource perspective. *Cogent Education, 9*(1), 2082118. https://doi.org/10.1080/2331186X.2022.2082118
12. Bakhiet, S., F., & Mohamed, H. (2022). Gifted education in Sudan: Reviews from a learning-resource perspective. *Cogent Education, 9*(1), 2034246. https://doi.org/10.1080/2331186X.2022.2034246
13. Banks, D. (1997). *Clusters of talent. Classification society of North America newsletter 48m*. http://www.pitt.edu/~csna/news/csna.news48.html
14. Barab, S. A., & Plucker, J. A. (2002). Smart people or smart contexts? Cognition, ability, and talent development in an age of situated approaches to knowing and learning. *Educational Psychologist, 37*(3), 165–182. https://doi.org/10.1207/S15326985EP3703_3
15. Binet, A., & Simon, T. (1905). *L'Étude expérimentale de l'intelligence* [The experimental study of intelligence]. Paris: Schleicher Frères.
16. Britannica (2024, Sep 04). *Dispersion (biology)*. In Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/dispersion-biology
17. Bronfenbrenner, U. (1992). *Ecological systems theory*. London, UK: Jessica Kingsley Publishers.
18. Chacón Soto, F. (2024). Gifted education in Costa Rica: analyses from a learning-resource perspective. *Cogent Education, 11*(1), 2397184. https://doi.org/10.1080/2331186X.2024.2397184
19. Chandler, K. L. (2013). Guest editor's commentary. *Journal for the Education of the Gifted, 36*(3), 255–411. https://doi.org/10.1177/0162353213494525
20. Chen, M. J., & Miller, D. (2010). West meets East: Toward an ambicultural approach to management. *Academy of Management Perspectives, 24*(4), 17–24. https://doi.org/10.5465/amp.2010.24.4.3651479.a
21. Collins Dictionary (2024, Sep 04). *Golden age*. Retrieved from https://www.collinsdictionary.com/dictionary/english/golden-age
22. Coyle, D. (2009). *The talent code: Greatness isn't born: It's grown: Here's how*. Bantam.
23. Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. Harper Perennial.
24. Dai, D. Y. (2024). *The nature and nurture of talent: A new foundation for human excellence*. Cambridge, MA: Cambridge University Press. Dai, D., & Kuo, C. C. (Eds.). (2017). *Gifted education in Asia: Problems and prospects*. Charlotte, NC: Information Age Publishing.
25. Dasgupta, S., Papadimitriou, C., & Vazirani, U. (2008). *Algorithms*. New York: McGraw-Hill.

 doi:10.20944/preprints202504.2268.v1

26. Dweck, C. S., & Yeager, D. S. (2019). Mindsets: A view from two eras. *Perspectives on Psychological Science, 14*(3), 481–496. https://doi.org/10.1177/1745691618804166
27. Eberstadt, N. & Abramsky, E. (2022). *The changing global distribution of highly educated manpower, 1950–2040: Findings and implications*. Washington, DC: The American Enterprise Institute.
28. Elbe, A. M., Madsen, C., & Midtgaard, J. (2010). A cross-cultural comparison of motivational factors in Kenyan and Danish middle and long distance elite runners. *Journal of Psychology in Africa, 20*(3), 421–427. https://doi.org/10.1080/14330237.2010.10820394
29. Elliot, A. J. (2020). Competition and achievement outcomes: A hierarchical motivational analysis. *Motivation Science, 6*(1), 3–11. https://doi.org/10.1037/mot0000164
30. Ericsson, K. A., Charness, N., Feltovich, P. J., & Hoffman, R. R. (Eds.) (2006). *The Cambridge handbook of expertise and expert performance*. New York, NY: Cambridge University Press.
31. Fischer, C., Fischer-Ontrup, C. & Schuster, C. (2021). Lernstrategien in der Begabtenförderung [Learning strategies in gifted education]. In V. Müller-Oppliger & G. Weigand (Eds.), *Handbuch Begabung* (pp. 402–417). Weinheim: Beltz.
32. Fuszek, C., Csermely, P., O´Reilly, C., & Ziegler, A. (2018). Towards a network approach to talent development*: The European Talent Support Network. Giftedness, 15*, 197–209.
33. Irueste, P., Saco, A., & Sarpakunnas, P. (2024). Educational and learning resources for gifted and talented people: Perspective of professional women from Argentina. *Cogent Education, 11*(1), 2391660. https://doi.org/10.1080/2331186X.2024.2391660
34. Gagné, F. (2009). Building gifts into talents: Detailed overview of the DMGT 2.0. In B. MacFarlane & T. Stambaugh, (Eds.), *Leading change in gifted education: The festschrift of Dr. Joyce VanTassel-Baska* (pp. 61–80). Waco (TX): Prufrock Press.
35. Gagné, F. (2020). *Differentiating giftedness from talent: The DMGT perspective on talent development*. Routledge.
36. Galton, F. (1869/1979). *Hereditary genius: An inquiry into its laws and consequences*. London: Julian Friedman Publishers.
37. Gieseler, K., Loschelder, D. D., & Friese, M. (2019). What makes for a good theory? How to evaluate a theory using the strength model of self-control as an example. In K. Sassenberg, M. L. W. Vliek (Eds.), *Social psychology in action: Evidence-based interventions from theory to practice* (pp. 3–21). https://doi.org/10.1007/978-3-030-13788-5_1
38. Goertzel, V., & Goertzel, M.G. (1962). *Cradles of eminence*. Little Brown & Company.
39. Gomez-Arizaga, M. P., Conejeros-Solar, M. L., & Cornejo-Araya, C. (2024). Gifted education in Chile: analyses from a learning-resource perspective. *Cogent Education, 11*(1), 2397217. https://doi.org/10.1080/2331186X.2024.2397217
40. Gruber, R., Wise, M. S., Frenette, S., Knäauper, B., Boom, A., Fontil, L., & Carrier, J. (2013). The association between sleep spindles and IQ in healthy school-age children. *International Journal of Psychophysiology, 89*(2), 229–240. https://doi.org/10.1016/j.ijpsycho.2013.03.018
41. Harding, S. (1975). *Can theories be refuted? Essays on the Duhem-Quine thesis* (Vol. 81). Springer Science & Business Media.
42. Hafsyan, A. S. (2023). Gifted education in the State of Kuwait: Review from a learning-resource perspective. *Cogent Education, 10*(1), 2224518. https://doi.org/10.1080/2331186X.2023.2224518
43. Heller, K. A., Mönks, F. J., Subotnik, R., & Sternberg, R. J. (Eds.). (2000). *International handbook of giftedness and talent*. Oxford: Pergamon.
44. Heller, K. A., Perleth, C., & Lim, T. K. (2005). The Munich model of giftedness designed to identify and promote gifted students. In R. J. Sternberg & J. E. Davidson (Eds.), Conceptions of giftedness (pp. 147–170). Cambridge University Press.
45. Hemdan, A. H., Ambusaidi, A., & Al-Kharusi, T. (2022). Gifted education in Oman: Analyses from a learning-resource perspective. *Cogent Education, 9*(1), 2064410. https://doi.org/10.1080/2331186X.2022.2064410
46. Hollingworth, L. S. (1926). *Gifted children: Their nature and nurture*. Macmillan.
47. Hollingworth, L. S. (1931). The child of very superior intelligence as a special problem in social adjustment. *Mental Hygiene, 15*, 3–16. https://doi.org/10.1177/000271623014900314

 doi:10.20944/preprints202504.2268.v1

48. Hood, L. (2012). Effectiveness and implications of homeschooling for gifted students. In C. M. Callahan & H. L. Hertberg-Davis (Eds.), *Fundamentals of gifted education: Considering multiple perspectives* (pp 248–255). London: Routledge.
49. Hsin, A., & Xie, Y. (2014). Explaining Asian Americans' academic advantage over Whites. *Proceedings of the National Academy of Sciences of the United States of America, 111*(23), 8416–8421. https://doi.org/10.1073/pnas.1406402111
50. IMO (2024, Sep 04). *International Mathematical Olympiad (IMO): Results*. Retrieved from https://www.imo-official.org/results.aspx
51. Islam, S. I. (2019). Science, technology, engineering and mathematics (STEM): Liberating women in the Middle East. *World Journal of Education, 9*(3), 94–104. https://doi.org/10.5430/wje.v9n3p94
52. Ismail, S. A., Alghawi, M. A., & AlSuwaidi, K. A. (2022). Gifted education in United Arab Emirates: Analyses from a learning-resource perspective. *Cogent Education, 9*(1), 2034247. https://doi.org/10.1080/2331186X.2022.2034247
53. Ismail, S. A., Alghawi, M. A., & AlSuwaidi, K. A. (2023). Conclusion: A winding up for the standing of education and learning resources in Arab states. *Cogent Education, 10*(2), 2251641. https://doi.org/10.1080/2331186X.2023.2251641
54. Kim, M. (2016). A meta-analysis of the effects of enrichment programs on gifted students. *Gifted Child Quarterly, 60*(2), 102–116. https://doi.org/10.1177/00169862166306
55. Kitzbühel. (2024, Sep 04). In *Wikipedia*. https://de.wikipedia.org/wiki/Kitzb%C3%BChel#Pers%C3%B6nlichkeiten
56. Lee, J. W., & Lee, H. (2016). Human capital in the long run. *Journal of Development Economics, 122*, 147–169. http://dx.doi.org/10.1016/j.jdeveco.2016.05.006
57. List of personalities of Salzburg (2024, Sep 04). In *Wikipedia*. https://de.wikipedia.org/wiki/Liste_von_Pers%C3%B6nlichkeiten_der_Stadt_Salzburg
58. Long, D. A., McCoach, D. B., Siegle, D., Callahan, C. M., & Gubbins, E. J. (2023). Inequality at the starting line: Underrepresentation of gifted identification and disparities in early achievement. *AERA Open, 9*. https://doi.org/10.1177/23328584231171535
59. Luhmann, N. (1995). *Social systems*. Stanford University Press.
60. Michaels, E., Handfield-Jones, H., & Axelrod, B. (2001). *The war for talent*. Boston: Harvard Business School.
61. Mirman, N. J. (2003). Identifying and selecting teachers. In J. F. Smutny (Ed.), *Designing and developing programs for gifted students (pp. 39–47). Corwin Press.*
62. Mönks, F. J. (1992). Development of gifted children: The issue of identification and programming. In F. J. Mönks & W. A. M. Peters (Eds.), *Talent for the future* (pp. 191–202). Van Gorcum.
63. Muglia Wechsler, S., Palmeira Pereira, V. L., & Delou, C. M. C. (2024). Educating the gifted in Brazil: Analysis from a learning-resource perspective. *Cogent Education, 11*(1), 2327761. https://doi.org/10.1080/2331186X.2024.2327761
64. Nardini, G., Rank-Christman, T., Bublitz, M. G., Cross, S. N., & Peracchio, L. A. (2021). Together we rise: How social movements succeed. *Journal of Consumer Psychology, 31*(1), 112–145. https://doi.org/10.1002/jcpy.1201
65. Nasir, N. I. S., Lee, C. D., Pea, R., & McKinney de Royston, M. (2020). *Handbook of the cultural foundations of learning* (p. 480). London: Taylor & Francis.
66. Nobel Prize Committee (2024, Sep 04). *All Nobel Prizes*. Retrieved from https://www.nobelprize.org/prizes/lists/all-nobel-prizes/
67. Nunez, M., Yu, H.-P., & Ziegler, A. (2023). Can eminence in STEAM produce more female role models? Recent trends in prizes known as the Nobel or the highest honors of a field. *Contemporary Educational Research Quarterly, 31*(3). https://doi.org/10.6151/CERQ.202309_31(3).0001
68. O'Connell, C. (1996). Environmental conditions, training systems and performance development of Kenyan runners. *New Studies in Athletics, 11*, 25–36.
69. OECD (2012). *Does money buy strong performance in PISA? PISA in focus, 13*. OECD Publishing, Paris. https://doi.org/10.1787/5k9fhmfzc4xx-en.

 doi:10.20944/preprints202504.2268.v1

70. OECD (2019*). PISA 2018 results (Vol. I): What students know and can do*. Paris: OECD Publishing. https://doi.org/10.1787/5f07c754-en.
71. Onywera, V. O., Scott, R. A., Boit, M. K., & Pitsiladis, Y. P. (2006). Demographic characteristics of elite Kenyan endurance runners. *Journal of Sports Sciences, 24*(4), 415–422. https://doi.org/10.1080/02640410500189033
72. Paik, S. J., Choe, S. M. M., Otto, W. J., & Rahman, Z. (2018). Learning about the lives and early experiences of notable Asian American women: Productive giftedness, childhood traits, and supportive conditions. *Journal for the Education of the Gifted, 41*(2), 160–192. https://doi.org/10.1177/0162353218763927
73. Paik, S. J., Kunisaki, L., Tran, V. Q., & Garcia, I. (2021). Developing talent into creative eminence: Understanding the productive giftedness of world class artists. *Gifted and Talented International, 36*(1-2), 15–31. https://doi.org/10.1080/15332276.2021.1961108
74. Paprotny, D. (2021). Convergence between developed and developing countries: a centennial perspective. *Social Indicators Research, 153*(1), 193–225. https://doi.org/10.1007/s11205-020-02488-4
75. Peters, S. J. (2022). The challenges of achieving equity within public school gifted and talented programs. *Gifted Child Quarterly, 66*(2), 82–94. https://doi.org/10.1177/001698622110025
76. Phillipson, S., Stoeger, H., & Ziegler, A. (Eds.). (2013*). Exceptionality in East-Asia: Explorations in the Actiotope model of giftedness*. London: Routledge.
77. Plomin, R., & Hershberger, S. (1991). Genotype environment interaction. In T. D. Wachs & R. Plomin, (Eds.), *Conceptualization and measurement of organism-environment interaction* (pp. 162–182). Washington, DC: American Psychological Association.
78. Plomin, R., & Rende, R. (1991). Human behavioral genetics. *Annual Review of Psychology, 42*(1), 161–190. https://doi.org/10.1146/annurev.ps.42.020191.001113
79. Plucker, J. A., & Peters, S. J. (2016). *Excellence gaps in education: Expanding opportunities for talented students*. Harvard Education Press.
80. Popov, V. (2009). Why the West became rich before China and Why China has been catching up with the West since 1949: Another Explanation of the "Great Divergence" and "Great Convergence" Stories. In *Comparative Research on Major Regional Powers in Eurasia-Paper 2* (pp. 27–56). Hokkaido Slavic-Eurasian Research Center. https://doi.org/10.1093/acprof:oso/9780198703631.003.0003
81. Portenga, S. (2019). High-performance talent development in gold. In R. F. Subotnik, P. Olszewski-Kubilius, & A. C. Worrell (Eds.), *The psychology of high performance* (p. 23–52). Washington, DC: APA.
82. QS Top universities (2024, Sep 04). *QS World University Rankings 2023: Top global universities*. Retrieved from https://www.topuniversities.com/university-rankings/world-university-rankings/2023
83. Renzulli, J. S. (1986). The three-ring conception of giftedness. In R. J. Sternberg & J. E. Davidson (Ed.), *Conceptions of giftedness* (S. 96–111). Cambridge: University Press.
84. Renzulli, J. S., & Reis Renzulli, S. (2010). The schoolwide enrichment model: A focus on student strengths and interests. *Gifted Education International, 26*(2-3), 140–156. https://doi.org/10.1177/026142941002600303
85. Research.com (2023, Nov 21). *Best social sciences and humanities scientists*. Retrieved from https://research.com/scientists-rankings/social-sciences-and-humanities
86. Rindermann, H. (2011). Results in the International Mathematical Olympiad (IMO) as indicators of the intellectual classes' cognitive-ability level. In A. Ziegler & Ch. Perleth (Eds.*), Excellence. Essays in honour of Kurt. A. Heller* (pp. 303–321). Münster, Germany: Lit.
87. Rindermann, H. (2018). *Cognitive capitalism: Human capital and the well-being of nations*. Cambridge University Press.
88. Roser, M. (2024, Sep 04). *Share of students achieving advanced learning outcomes, 1970 to 2015*. Retrieved from https://ourworldindata.org/grapher/share-of-students-achieving-the-advanced-threshold-score
89. Roser, M. & Ortiz-Ospina, E. (2024). *Literacy*. Retrieved from: https://ourworldindata.org/literacy
90. Sady, W. (2021). Ludwik Fleck. In E. N. Zalta & U. Nodelman (eds.), *The Stanford Encyclopedia of Philosophy* (Fall 2023 Edition). Retrieved from https://plato.stanford.edu/entries/fleck/
91. Salisbury, F. (1992). *Plant physiology* (4th ed.). Belmont, CA: Wadsworth.

 doi:10.20944/preprints202504.2268.v1

92. Saul, M., & Vaderlind, P. (2022). Outreach by the International Mathematical Olympiad to the mathematics education community. *ZDM–Mathematics Education, 54*(5), 997–1007. https://doi.org/ 10.1007/s11858-022-01381-3
93. Scarr, S. (1981). *Race, social class, and individual differences in I.Q.* Hillsdale, NJ: Erlbaum.
94. Shavinina, L. V. (Ed.). (2009). *International handbook on giftedness* (Vol. 2). New York, NY: Springer.
95. Shore, B. M. (2021). Context matters in gifted education. *Education Sciences, 11*(8), 424. https://doi.org/10.3390/educsci11080424
96. Siegert, R. S. & Levack, W. M. M. (Eds.). (2014). *Rehabilitation goal setting: Theory, practice, and evidence*. London: Taylor & Francis.
97. Simonton, D. K. (1994). *Greatness: Who makes history and why*. Guilford Press.
98. Simonton, D. K. (2003). Creative cultures, nations, and civilizations: Strategies and results. In P. B. Paulus & B. A. Nijstad (Eds.), *Group creativity: Innovation through collaboration* (pp. 304–328). New York: Oxford University Press.
99. Spearman, C. (1961). The abilities of man. In J. J. Jenkins & D. G. Paterson (Eds.), *Studies in individual differences: The search for intelligence* (pp. 241–266). New York: Appleton-Century-Crofts. https://doi.org/10.1037/11491-021
100. Statista (2024, Sep 04). *Top-selling artists worldwide as of August 2022*. Retrieved from https://www.statista.com/statistics/271174/
101. Stern, W. (1900). *Über Psychologie der individuellen Differenzen: Ideen zu einer „differentiellen Psychologie*“ [On the psychology of individual differences: Ideas for a „differential psychology“]. Leipzig: Johann Ambrosius Barth.
102. Sternberg, R. J. (2005). The WICS model of giftedness. In R. Sternberg & J. Davidson (Eds.), *Conceptions of giftedness* (pp. 327–342). Cambridge: University Press.
103. Sternberg, R. J. (2023). Giftedness does not reside within a person: Defining giftedness in society is a three-step process. *Roeper Review, 45*(1), 50–60. https://doi.org/10.1080/02783193.2022.2145400
104. Sternberg, R. J., & Ambrose, D. (Eds.). (2020). *Conceptions of giftedness and talent*. Palgrave- Macmillan.
105. Stoeger, H. (2009). The history of giftedness research. In L. V. Shavinia (Ed.), *International handbook on giftedness* (pp. 17–38). New York, NY: Springer.
106. Stoeger, H., Almulhim, N., & Ziegler, A. (2022). Correspondence heuristic and filter-empowerment heuristic: Investigating the reversed gender achievement gap in a sample of secondary school students in Saudi Arabia within the framework of educational and learning capital. *Education Sciences, 12*, 811. https://doi.org/10.3390/educsci12110811
107. Stoeger, H., Balestrini, D. P., & Ziegler, A. (2018). International perspectives and trends in research on giftedness and talent development. In S. I. Pfeiffer, E. Shaunessy-Dedrick, & M. Foley-Nicpon (Eds.), *APA handbook of giftedness and talent* (pp. 25–37). Washington, DC: American Psychological Association. https://doi.org/10.1037/0000038-002
108. Stoeger, H., Greindl, T., Kuhlmann, T., & Balestrini, D. (2017). The learning and educational capital of male and female students in STEM magnet schools and in extracurricular STEM programs: A study in high-achiever-track secondary schools in Germany. *Journal for the Education of the Gifted, 40*(4), 394–416. https://doi.org/10.1177/0162353217734374
109. Stoeger, H., Luo, L., & Ziegler, A. (2024). Attracting and developing STEMM talent towards excellence and innovation. *Annals of the New York Academy of Sciences, 1533*(1), 89–98. https://doi.org/10.1111/nyas.15108
110. Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2011). Rethinking giftedness and gifted education: A proposed direction forward based on psychological science. *Psychological Science in the Public Interest, 12*(1), 3–54. Supplement. https://doi.org/10.1177/1529100611418056
111. Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2019). *The psychology of high performance*. American Psychological Association.
112. Sue, S., & Okazaki, S. (1990). Asian-American educational achievements: A phenomenon in search of an explanation. *American Psychologist, 45*(8), 913–920. https://doi.org/10.1037/0003-066X.45.8.913
113. Sutherland, M., & Reid, C. (2023). A small country with big ambitions: Does this include the gifted? *Education Sciences, 13*(8), 832. https://doi.org/10.3390/educsci13080832

 doi:10.20944/preprints202504.2268.v1

114. Tannenbaum, J. A. (1983). *Gifted children: Psychological and educational perspectives*. New York: Macmillan.
115. Terman, L. M. (1922). A new approach to the study of genius. *Psychological Review, 29*(4), 310–318. https://doi.org/10.1037/h0071072
116. Terman, L. M. (1925). *The measurement of intelligence: An explanation of and a complete guide for the use of the Stanford revision and extension of the Binet-Simon intelligence scale*. Boston: Houghton Mifflin.
117. Thuany, M., Gomes, T. N., Weiss, K., Knechtle, B., Rolim, R., & Dos Santos, M. A. M. (2023). Beyond the border of the athlete-centered approach: a model to understand runners' performance. *Frontiers in Psychology, 14*, 1137023. https://doi.org/10.3389/fpsyg.2023.1137023
118. Tung, R. L. (2023). To make JIBS matter for a better world. *Journal of International Business Studies, 54*(1), 1–10. https://doi.org/10.1057/s41267-022-00569-9
119. von Bertalanffy, L. (1975). *Perspectives on general system theory: Scientific-philosophical studies*. New York, NY: George Brazilier.
120. VanTassel-Baska, J. (2013). International perspectives on gifted education and talent development, part I [Special issue]. *Journal for the Education of the Gifted, 36*(1). https://doi.org/10.1177/0162353212473175
121. Vialle, W. (2013). The 'Tiger Mother' factor: Curriculum, schooling and mentoring of Asian students in an Australian context. In S. N. Phillipson, H. Stoeger & A. Ziegler (Eds.), *Exceptionality in East Asia* (pp. 147–166). Routledge.
122. Vialle, W., & Stoeger, H. (2018). Educational and learning capital: Implications for gifted education. *Journal for the Education of the Gifted, 41*(4), 295–297. https://doi.org/10.1177/0162353218807775
123. Vuyk, A., Montania, M., Barrios, L., & Lobo, M. (2024). Gifted education in Paraguay: analyses from a learning-resource perspective. *Cogent Education, 11*(1), 2332863. https://doi.org/10.1080/2331186X.2024.2332863
124. WIPO (2021, August 19). *World Intellectual Property Indicators 2021*. Geneva: World Intellectual Property Organization. Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2021.pdf
125. WorldAtlas (2024, Sep 04). *The most popular sports in the world*. Retrieved from https://www.worldatlas.com/articles/what-are-the-most-popular-sports-in-the-world.html
126. WorldSkills (2024a, Sep 04). *Members*. Retrieved from https://worldskills.org/members/
127. WorldSkills (2024b, Sep 04). *Results*. Retrieved from https://results.worldskills.org/results
128. Zhao, X. (2021). *The influence of the learning environment on gifted students in China* (Doctoral dissertation), Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU).
129. Ziegler, A. & Baker, J. (2013). Talent development as adaption: The role of educational and learning capital. In S. Phillipson, H. Stoeger, & A. Ziegler (Eds.), *Exceptionality in East-Asia: Explorations in the Actiotope model of giftedness* (pp. 18-39). London: Routledge.
130. Ziegler, A., Balestrini, D., & Stoeger, H. (2018). An international view on gifted education: Incorporating the macro-systemic perspective. In S. Pfeiffer (Ed.), *Handbook of giftedness in children: Psychoeducational theory, research, and best practices* (pp. 15–28). New York: Springer. https://doi.org/10.1007/978-3-319-77004-8_2
131. Ziegler, A., Chandler, K., Vialle, W., & Stoeger, H. (2017). Exogenous and endogenous learning resources in the Actiotope Model of Giftedness and its significance for gifted education. *Journal for the Education of the Gifted, 40*(4), 310–333. https://doi.org/10.1177/0162353217734376
132. Ziegler, A., Luo, L., & Stoeger, H. (2023). Equity gaps in literacy among elementary school students from two countries: The negative social resonance effect of intersectional disadvantage and the dampening effect of learning capital. *Education Sciences, 13(8), 827*. https://dx.doi.org/10.3390/educsci13080827
133. Ziegler, A., & Phillipson, S. N. (2012). Towards a systemic theory of gifted education. *High Ability Studies, 23*(1), 3–30. https://doi.org/10.1080/13598139.2012.679085
134. Ziegler, A. & Stoeger, H. (2023a). First steps toward assessing talent- support systems on a country level. *High Ability Studies, 34*(1), 1–19. https://doi.org/10.1080/13598139.2023.220611
135. Ziegler, A. & Stoeger, H. (2023b). Talent denied: Equity and excellence gaps in STEMM. *Annals of the New York Academy of Sciences, 1530*(1), 32–45. https://doi.org/10.1111/nyas.15083
136. Ziegler, A., & Stoeger, H. (2017). Systemic gifted education. A theoretical introduction. *Gifted Child Quarterly, 61*(3), 183–193. https://doi.org/10.1177/0016986217705

 doi:10.20944/preprints202504.2268.v1

137. Ziegler, A., Stoeger, H., & Balestrini, D. (2017). Systemic gifted education. In C. O´Reilly, T. Cross, & J. Riedl Cross (Eds.), *Provisions for gifted students* (pp. 15-56) Dublin: CTYI Press.
138. Ziegler, A. & Vialle, W. (2017). Using the Actiotope Model of Giftedness to bridge the gap between experiences and practice. In J. A. Plucker, A. N. Rinn, & M. C. Makel (Eds.), *From giftedness to gifted education: Reflecting theory in practice* (pp. 203–226). Waco, TX: Prufrock Press.
139. Ziegler, A. & Vialle, W. (2025). The systemic perspective on giftedness. In L. Hogeveen, E. Kroesbergen, C. O'Reilly, & K. Verschueren (Eds.), *European handbook of giftedness and talent development*. In press.