

# The key role of early education in an ageing and shrinking population: The example of Germany

*Elke Loichinger*<sup>1,\*</sup>  and *C. Katharina Spiess*<sup>1</sup> 

## Abstract

Germany is currently among the 10 oldest countries in the world, as measured by the share of population aged 70 years and over. With the baby boomer cohorts of the 1950s and 1960s having started to reach retirement ages, a new phase of ageing is about to take place. In this debate piece, we argue that investments in human capital at any age and at any stage of the life course are indispensable for dealing with an ageing population. Investments in early education are most effective and efficient, as early skills beget later skills. We show that in an ageing society, it is most efficient to invest in children from the very beginning to develop their full human potential, and to ensure that no child is left behind. Moreover, investments in early education programmes have benefits in addition to those directly related to children, including benefits related to fertility, maternal employment and the integration of parents with a migration background. Globally, more and more countries are faced with increasing proportions of older people and decreasing proportions of working-age people in their populations. Thus, what we describe here for Germany can in many respects be transferred to other country contexts.

**Keywords:** population ageing; human capital; education; early education programmes

## 1 Demographic trends in Germany

Germany is currently among the 10 oldest countries in the world, as measured by the share of population aged 70 years and over. Life expectancy has been increasing and the total fertility rate (TFR) has been continuously below the so-called replacement level of 2.1 children per woman since the early 1970s (and even, on occasion, before

---

<sup>1</sup>Federal Institute for Population Research (BiB), Wiesbaden, Germany

\*Correspondence to: Elke Loichinger, [elke.loichinger@bib.bund.de](mailto:elke.loichinger@bib.bund.de)

then). At present, the TFR stands at 1.6 children per woman, and it is unlikely to rise significantly in the near future, despite some moderate increases recorded in recent years. Moreover, the number of deaths has surpassed the number of births in every single year since the early 1970s, leading to negative natural population growth. This means that the population would have started shrinking about 50 years ago had it not been for the effect of immigration. As positive net migration – i.e. more immigrants than emigrants – made up for the deficit in births over deaths in most years, the population in Germany increased from 77.7 million in 1970 to 84.4 million in 2022.

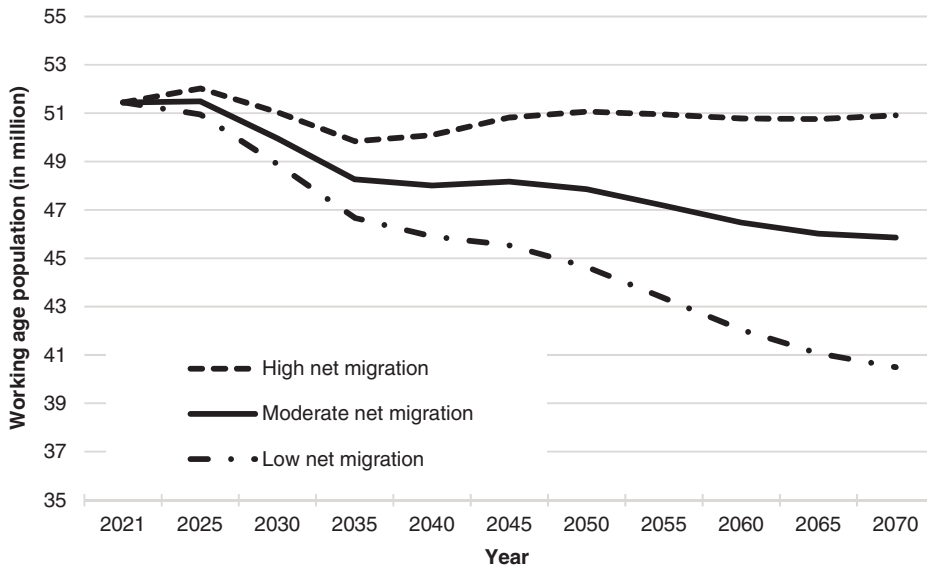
Germany has been a country of immigration for decades, attracting migrants from a wide range of origin countries. Germany has the second-largest absolute number of foreign-born residents globally, after the United States (McAuliffe and Triandafyllidou, 2021). As a result, 27% of the population have a so-called migration background, which means that either the individuals themselves or at least one of their parents did not possess German citizenship at birth. Between 2005 and 2021, the increase in the share of the population with a migration background was more pronounced among children below age 10 than among other age groups, rising from just over one in four to almost one in two. Germany is actively trying to attract labour migrants from abroad, and it is reasonable to expect further refugee migration and other forms of migration to Germany. Therefore, the share of persons with a migration background in the German population is expected to increase in the future.

Given that the birth deficit is likely to grow as the baby boomers born in the 1950s and 1960s get older, and assuming that there is no extraordinary increase in the TFR, immigration will continue to be the decisive factor in whether the population of Germany increases, stagnates or decreases over the coming decades. The moderate variant (Variant 2) of the latest official projections by the Federal Statistical Office of Germany is based on the assumptions of moderate further increases in life expectancy, a TFR of 1.55 and average net migration of 290,000 persons per year. Under these assumptions, the size of Germany's population would remain barely unchanged for the next 50 years.<sup>1</sup> The ongoing change in the age composition would, however, continue: the share of the population aged 67 and older is projected to increase from 20% currently to 25% in 2040. Age 67 is the soon-to-be statutory retirement age. Over the same period, the share of the population aged 20 to 66 is projected to fall from 62% to 57%. While this change in the working-age population might not seem very large in relative terms, it means that the number of people of working age will decline by about four million in less than 20 years. As Figure 1 illustrates, the future size of the working-age population will depend on the volume of net migration. However, worries about the labour supply are not just concerns for the future, but are already a reality today, as it is becoming increasingly difficult to fill open positions at various skill levels and in a range of occupations, including openings for professional

---

<sup>1</sup> Under a scenario with low net migration assumptions (180,000 net migrants per year), the population is projected to decrease to 74.5 million in 2070; while under a high net migration scenario (400,000 net migrants per year), the population is projected to increase to 89.8 million (Destatis, 2022).

**Figure 1:**  
**Population of working age (20 to 66 years), by migration variant (low, moderate and high net migration assumptions)**



Source: Destatis (2022), own depiction.

workers in the (health) care sector and the IT sector, qualified craftsmen and low-wage service workers (e.g., Fitzenberger, 2023).

## 2 Investing in education as a strategy for coping with demographic change

Investment in a population's human capital is increasingly recognised as one of several strategies for coping with demographic change, not least because it is one parameter used to increase labour potential and productivity in an ageing society, alongside increasing the labour force participation of women and persons who do not have German or another EU country's citizenship, increasing working hours, raising the retirement age, labour migration, and the expansion of automation and AI. In Germany, as in other high-income countries, employment rates are highest and unemployment is lowest among people with higher levels of education (e.g., Loichinger, 2015). Among the potential reasons for this advantage are positive selection into higher education, opportunity costs, the association between education and health outcomes, and differences in job quality and opportunities. This positive association between education and employment reflects the returns to education at the

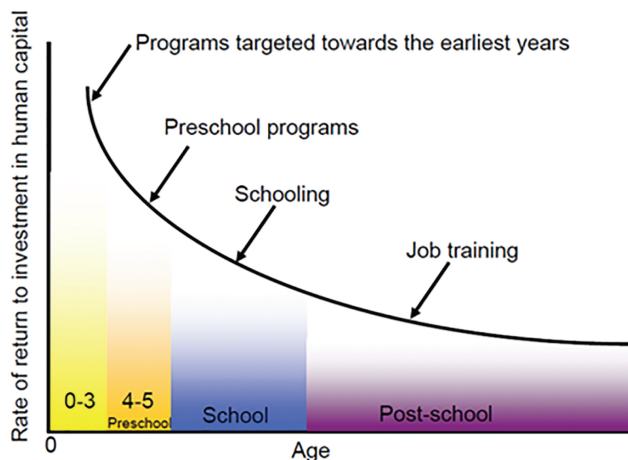
individual as well as at the societal level, and points to the relevance of investments in education, particularly in contexts with declining labour potential. However, it is not only the labour shortage that makes education so important in ageing societies, as there are many other outcomes that might improve through education, and that are important in light of demographic change, including life satisfaction and healthy life expectancy. Furthermore, it is not education per se that is the most effective and efficient tool to tackle demographic change. As we will argue in this debate piece, investments in early education are particularly important in an ageing population with relatively small birth cohorts, and with a significant share of children who are growing up in a non-German-speaking household.

### **3 Human capital investments – what does the research tell us?**

The discussion of investments in education raises several questions. Important ones are: When are investments most effective and, even more importantly, when are they most efficient? Among education researchers, it is primarily education economists who deal with these questions. Most international and national studies that have addressed these issues in recent years have pointed to the high effectiveness and efficiency of investments in early education (e.g., Cunha and Heckman, 2008; Spiess, 2017). This finding is the result of the so-called multiplier effects that these investments produce, given that early skills are the basis of later skills. This means that skill gaps that develop at one point in childhood persist into higher ages, and may even widen because skills are self-reinforcing. Moreover, skills acquired earlier in life tend to increase the productivity of investments in skills later on (“skills beget skills”). Research has shown that all children, but especially those from disadvantaged families, benefit from early investments in education. Education researchers have also emphasised that the quality of the programmes matters, i.e. a certain level of programme quality is the precondition for positive education effects (e.g., Barnett, 2011). Thus, targeted spending on good quality programmes in the early years of the life course is a very effective measure for increasing the human capital of ageing societies. Moreover, the existing efficiency studies have shown that investments in these earlier years are not only very effective, but are efficient as well, at least once a long-term perspective is considered. This argument is closely linked to the work of the Nobel Prize winner James Heckman and his co-authors, who investigated such efficiencies mainly based on examples of special programmes in the United States. Heckman summarised this research in a stylised graph showing the high returns related to early investment in high-quality programmes (see Figure 2).

However, it is often noted critically in this context that at least some of the evidence on which Heckman’s graph was based came from longitudinal studies that examined “only” high-quality programmes for highly selective groups of children in specific regions of the US. While it is clear that these studies found evidence of high

**Figure 2:**  
**Rate of return to investment in human capital by age**



**Source:** Authors' extrapolation and adaption of Figure 2 in Heckman (2006, p. 1901) with permission from the American Association for the Advancement of Science.

knowledge gains, it is certainly also true that their results cannot be transferred 1:1 to the German context, or to other contexts. Research on the economics of education in recent years has generated further evidence that is much more transferable to the German context, or that is even based on German data. This is the research that has examined the impact of universal early education programmes in European countries; i.e. of those services that are basically available to all children, and are not targeted to specific groups (Spiess, 2017). For example, the results of a study based on Norwegian data demonstrated the long-term effectiveness of the expansion of publicly funded early education programmes. In the work of Havnes and Mogstad (2011, 2015), human capital has been shown to have increased contingent on an expansion of publicly funded early education and care programmes. The authors found that this expansion increased the number of students who finished school and who attended college, and reduced the number of social assistance recipients, to mention just a few effects. Other studies based on European data found evidence of medium-term effects of investments in such programmes mainly up to school age. Studies for Germany (for a summary, see Spieß, 2021) showed that investments in early education programmes increased human capital, for instance in the form of non-cognitive skills that are particularly relevant for later labour market outcomes, and resulted in a higher degree of school readiness and more students attending higher secondary school (*Gymnasium*).

In addition, early education programmes have other positive effects that should be taken into account in light of the expected shrinking of the labour force in Germany. Many empirical studies have shown that these programmes increase the

maternal labour supply (e.g., Müller and Wrohlich, 2020) at both the extensive and the intensive margins, which means that they can help to increase both the labour force participation and the work volume of mothers. Thus, investments in early education programmes also allow earlier investments in the human capital of parents – in particular of mothers who would otherwise be unable to balance paid work and unpaid family work – to be used more broadly. In this respect, investments in early education can provide direct and immediate benefits, in addition to the child-related benefits that can take a number of years to feed through. Furthermore, early education programmes can have a positive impact on the realisation of fertility intentions. Studies for Germany have found that the expansion of publicly funded early education programmes in recent years has led to an increase in fertility (e.g., Bauernschuster et al., 2016), even though fertility is still well below the replacement level. It is, however, important to keep in mind that the labour market returns of fertility effects take even longer to materialise than the effects of investments in children’s human capital, as it takes the length of time from birth until labour market entry in the first instance, and a few years less, from early education programme attendance to labour market entry, in the second instance. And last but not least, there is empirical research showing that early education and care programmes can increase the integration of mothers whose children attend them (Gambaro et al., 2021).

Although investments in high-quality early education programmes can help to increase the human capital of both the current and the future labour force, this does not mean that investments in the education of individuals at later stages in the life course are not effective, especially over the short term. Thus, in addition to interventions targeted at young children, investments in the current generation of students and in the current workforce should also be improved to increase the productivity of an ageing society. More efforts should be made to reduce the percentage of children who leave school without graduating or who do not receive any further education or training, as depending on the country and the context, this group can represent a sizeable labour potential. In Germany, for example, almost one in five 30-year-olds does not have any vocational training or higher education. Finally, investments that support lifelong learning later in the life course should be expanded. As empirical research has shown that participants in further education are mainly individuals with higher socio-economic status (SES), more investments are needed to support lifelong learning among groups with lower socio-economic status, especially given that the latter are at higher risk of declining employability as they grow older.

#### **4 (Early) education policy in Germany – some facts**

In light of these findings from the international and national literature on the effectiveness and efficiency of educational investments, a question that arises is whether they are reflected in German education policy. While there have been many reforms in the early education sector in recent years – most notably the expansion

of early education programmes for children under age three – there are still many challenges to overcome. Empirical findings show that this expansion has primarily benefited children from families with higher levels of education and income: for example, the take-up rate of children under age three whose mothers have lower educational qualifications has increased to a disproportionately lower degree than that of other children (Schmitz et al., 2023). Children from families with lower socio-economic status or in which the parents have a migration background continue to be underrepresented in early education programmes. In 2020, the attendance rate of children under age three who had less well-educated mothers (without a university entry degree) was 28%, meaning that 28 out of 100 children below age three attended this programme; while the attendance rate of children who had a better educated mother (with a university entry degree) was 43%. The gap in attendance rates was also large between children depending on whether their family did (38%) or did not speak German (24%) at home (Schmitz et al., 2023). The latter finding is particularly noteworthy considering that children who do not speak German at home can acquire these language skills at early education programmes – an important skill for further learning in school.

Although such attendance differences are no longer observed among preschool children, the question of how the quality of education can be improved for these children arises, as it does for younger children. There is evidence that children from different socio-economic groups attend early education programmes that differ in quality, and that children from disadvantaged groups tend to use lower quality early education programmes, leading to further educational inequalities (Stahl et al., 2018). This is particularly serious because there are no national quality standards in Germany – an issue that has been debated for several years. It remains to be seen what steps the current government will take to reach its goal of introducing minimum standards aimed at ensuring that all children, regardless of their family background or the region where they live, attend early education and care centres with a certain level of quality. Thus, while further increases in public spending on early education are necessary, across-the-board increases do not seem to be the right approach. Instead, these increases should be combined with considerations of targeted support for children from disadvantaged groups as well as, for instance, for children whose mother tongue is not German. This is particularly important, given that the percentage of children being raised in a non-German-speaking household is increasing and will probably continue to rise in the future.

In addition to these inequalities in early education programmes, there are many other inequalities in the German educational system that hinder people from developing their full educational potential. Overall, public spending on education in Germany is still below the 2018 target of 10% of GDP. This target was set by the former German chancellor, who declared that Germany should become an “education republic” (*Bildungsrepublik Deutschland*). In 2021, education spending accounted for just 4.7% of GDP (Statistisches Bundesamt, 2022). Since Germany still spends relatively little on primary school children compared with other countries (OECD, 2022), investments should be increased, especially in this area. This is

particularly necessary given that a recent report on the development of skills among primary school pupils showed that in the first year of the coronavirus pandemic, there were significant skills losses compared with previous years (Stanat et al., 2022). Depending on the skills area, an average of 18% to 30% of pupils failed to achieve the minimum standards. The current trend in education shows that performance has declined in almost all federal states, albeit to very different degrees. At the same time, the gap between socially disadvantaged children – with and without a migration background – and children from privileged families has widened. More investments will be required to prevent these skills gaps from widening further. In addition, more money is needed to develop the skills of children with a migration background early on, otherwise the costs will be even higher later.

## **5 Recommendations for Germany (and other countries)**

Human capital investments at various stages of individuals' lives are needed to address the challenges of demographic change in both the short and the longer term. Although these investments will be expensive, failing to invest in early education today will prove even more costly in the future. Children from families with lower socio-economic status will particularly benefit from human capital investments. The education needs of many children with a migration background are also well-known, for example when it comes to language acquisition and skills. Having said that, it should be kept in mind that the group of those with a migration background is demographically and socio-economically quite diverse, just as the group of those without a migration background. In addition, given the capacity of investments in human capital to reduce the growing income and education gaps between population subgroups, such investments are effective tools for reducing social inequalities, and thus for increasing equality of educational opportunity. The goal of providing all children with quality education from an early age onwards is relevant not just to ageing societies – as a matter of fact, it is formulated as SDG (Sustainable Development Goal) target 4.2: “By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education”.

In an ageing society, it is important to develop the full educational potential of all members; hence, no child, youth or adult should be left without good quality early education, schooling, training or continuing education. While we focused here on education at an early age, providing education and training to people throughout their working lives is another important strategy for coping with demographic change. This approach is also useful in light of technological change and other developments that make lifelong learning necessary – regardless of demographic change, but again in particular due to demographic change. Engaging in continuing education throughout the life course should not be an option mainly for workers with higher socio-economic status, but should instead become part of everyone's working life. This would have a positive impact on overall employability into old age, a factor



that is key to extending working lives. The extension of working lives is a policy goal in Germany aimed at strengthening the sustainability of social security systems, especially the public pension system. Such training programmes should take place inside and outside of companies, and should increasingly provide on-the-job training as well. This latter kind of training allows employers to recruit new workers even if they lack some of the skills that are required for specific jobs, thereby enlarging the pool of potential applicants. Moreover, training programmes for the working population might also be one way to help migrants integrate further and faster into the German labour market. Reducing the number of bureaucratic hurdles migrants need to overcome before their educational qualifications are accepted in Germany might prove effective in this context.


While it is clear that there is a need to invest further in education to meet the challenges associated with demographic change in Germany, one question that remains to be answered is that of the administrative level at which such investments should be made. The answer depends on the context. Whereas decisions regarding investments in school education are made at the level of the 16 federal states in Germany, the situation is even more heterogeneous in the area of early education programmes outside of schools. The responsibility for funding early education programmes lies with local and state governments, while many on-the-job training programmes are funded either solely by employers or employees, or jointly by public and private actors. However, when considering the goal of increasing human capital, these differences should not matter, and discussions about who is responsible for spending cannot be an excuse for not investing further. What complicates this situation is that population ageing and especially population decline tend to manifest themselves differently at the subnational level. The latter poses different challenges for different regions, for example, in terms of attracting qualified education personnel. Today there is already a shortage of early education and school teachers for selected education levels and fields, and the competition for skilled personnel will likely increase further. The reasons for these challenges are related to both supply and demand: significant shares of educational personnel belong to the baby boomer cohorts and are about to retire, and the number of children below age 14 is projected to increase (Autor:innengruppe Bildungsberichterstattung, 2022).

Many of the conditions that have been described here for Germany can be transferred to other country contexts. In an increasing number of countries, the proportion of older people in the population will increase while the size of the working-age population and its share in the total population will decrease. Many countries are already seeing their populations shrink due to negative natural growth and/or emigration. According to the United Nations World Population Prospects 2022, 61 countries are projected to experience a population decline of 1% or more between now and 2050 (United Nations, 2022). While an unrealistically large number of migrants would be required to reverse the ageing process (Craveiro et al., 2019), immigration can slow this process and increase the number of working-age people in a given population. Depending on the level of immigration, the population will grow, stagnate or decline. Under all of these circumstances, investments in the human

capital of all members of society – with or without a migration background – will be beneficial for individuals and for society as a whole. And investments at young ages will be especially important.

## ORCID iDs

Elke Loichinger  <https://orcid.org/0000-0003-2538-5042>

C. Katharina Spiess  <https://orcid.org/0000-0001-5618-912X>

## References

- Autor:innengruppe Bildungsberichterstattung. (2022). *Bildung in Deutschland 2022. Ein indikatorengestützter Bericht mit einer Analyse zum Bildungspersonal*. wbv Media. <https://doi.org/10.3278/6001820hw>
- Barnett, W. S. (2011). Effectiveness of early educational intervention. *Science*, 333, 975–978. <https://doi.org/10.1126/science.1204534>
- Bauernschuster, S., Hener, T., and Rainer, H. (2016). Children of a (policy) revolution: The introduction of universal child care and its effect on fertility. *Journal of the European Economic Association*, 14(4), 975–1005. <https://doi.org/10.1111/jeea.12158>
- Craveiro, D., Tiago de Oliveira, I., Sousa Gomes, M. C., Malheiros, J., João Guardado Moreira, M., and Peixoto, J. (2019). Back to replacement migration: A new European perspective applying the prospective-age concept. *Demographic Research*, 40(45), 1323–1344. <https://doi.org/10.4054/DemRes.2019.40.45>
- Cunha, F., and Heckman, J. J. (2008). Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. *Journal of Human Resources*, 43(4), 738–782. <https://doi.org/10.3368/jhr.43.4.738>
- Destatis (2022). 15. koordinierte Bevölkerungsvorausberechnung – Deutschland. Berichtszeitraum 2021–2070. Ergänzung zur Datenbank GENESIS-online.
- Fitzenberger, B. (2023). Fach- und Arbeitskräftemangel . . . und es gibt ihn doch! *IAB-Forum*, 28 March 2023. <https://www.iab-forum.de/fach-und-arbeitskraeftemangel-und-es-gibt-ihn-doch/>
- Gambaro, L., Neidhoeffler, G., and Spiess, C. K. (2021). The effect of early childhood education and care services on the integration of refugee families. *Labour Economics*, 72, 102053. <https://doi.org/10.1016/j.labeco.2021.102053>
- Havnes, T., and Mogstad, M. (2011). No child left behind: Subsidized child care and children’s long-run outcomes. *American Economic Journal*, 3(2), 97–129. <https://doi.org/10.1257/pol.3.2.97>
- Havnes, T., and Mogstad, M. (2015). Is universal child care leveling the playing field? *Journal of Public Economics*, 127, 100–114. <https://doi.org/10.1016/j.jpubeco.2014.04.007>
- Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, 312(5782), 1900–1902. <https://doi.org/10.1126/science.1128898>

- McAuliffe, M. and Triandafyllidou, A. (Eds.). (2021). *World Migration Report 2022*. International Organization for Migration (IOM).
- Loichinger, E. (2015). Labor force projections up to 2053 for 26 EU countries, by age, sex, and highest level of educational attainment. *Demographic Research*, 32(15), 443–486. <https://doi.org/10.4054/DemRes.2015.32.15>
- Müller, K.-U., and Wrohlich, K. (2020). Does subsidized care for toddlers increase maternal labor supply? Evidence from a large-scale expansion of early childcare. *Labour Economics*, 62, 101776. <https://doi.org/10.1016/j.labeco.2019.101776>
- OECD. (2022). *Education at a Glance 2022: OECD Indicators*. OECD Publishing.
- Schmitz, S., Spieß, C. K., and Huebener, M. (2023). Weiterhin Ungleichheiten bei der KiTa-Nutzung. Größter ungedeckter Bedarf in grundsätzlich benachteiligten Familien. *Bevölkerungsforschung Aktuell*, 2/2023, 3–8.
- Stahl, J., Schober, P., and Spiess, C. K. (2018). Parental socio-economic status and childcare quality: Early inequalities in educational opportunity? *Early Childhood Research Quarterly*, 44(3), 304–317. <https://doi.org/10.1016/j.ecresq.2017.10.011>
- Spiess, C. K. (2017). Early childhood education and care services and child development: Economic perspectives for universal approaches. In Scott, R. A. and Kosslyn, S. M. (Eds.), *Emerging Trends in the Social and Behavioral Sciences* (pp. 1–14). John Wiley & Sons. <https://doi.org/10.1002/9781118900772.etrds0435>
- Spieß, C. K. (2021). Kita-Ökonomik – eine Perspektive für Deutschland. *Perspektiven der Wirtschaftspolitik*, 22(3), 25–37. <https://doi.org/10.1515/pwp-2021-0034>
- Stanat, P., Schipolowski, S., Schneider, R., Sachse, K. A., Weirich, S. and Henschel, S. (Eds.) (2022). IQB-Bildungstrend 2021 Kompetenzen in den Fächern Deutsch und Mathematik am Ende der 4. Jahrgangsstufe im dritten Ländervergleich. Waxmann Münster and New York. <https://doi.org/10.31244/9783830996064>
- Statistisches Bundesamt (Eds.) (2022). *Bildungsfinanzbericht 2022*.
- United Nations. (2022). *World Population Prospects 2022: Summary of Results*. United Nations, Department of Economic and Social Affairs, Population Division. DESA/POP/2022/TR/NO. 3.

**Open Access** This article is published under the terms of the Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by/4.0/>) that allows the sharing, use and adaptation in any medium, provided that the user gives appropriate credit, provides a link to the license, and indicates if changes were made.