Petra Stanat, Stefan Schipolowski, Sarah Gentrup,
Karoline A. Sachse, Sebastian Weirich, Sofie Henschel (Eds.)

IQB Trends in Student Achievement 2024

The Third National Assessment of Mathematics and Science Proficiencies at the End of 9th Grade

Summary

WAXMANN

This summary and the references contained herein reference the study report for the IQB Trends in Student Achievement 2024:

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The IQB Trends in Student Achievement 2024

1. Introduction to the study

The IQB Trends in Student Achievement provide a periodical review of the extent to which students in Germany are meeting the proficiency goals set under the educational standards of the Standing Conference of the Ministers of Education and Cultural Affairs of the States in the Federal Republic of Germany (KMK). In the subjects mathematics, biology, chemistry and physics, studies of proficiencies in secondary level I are performed at the end of the 9th grade. The IQB Trends in Student Achievement 2024, the results of which are reported in this summary and the regarding volume, marks the third survey of key proficiencies in these subjects, following the IQB National Assessment in 2012 and the IQB Trends in Student Achievement in 2018.

The evaluations that underlie the IQB Trends in Student Achievement 2024 have two areas of focus. The first concerns the extent to which the proficiency goals set by the KMK were met at the level of the federal states (Länder) in 2024 (distribution of students across the levels of proficiency). Drawing on the educational standards for both the first school leaving certificate (ESA)[1] and the secondary school leaving certificate (MSA) for the subject mathematics, first we report on the percentages of the total population of ninth-graders who do not meet the minimum standards for the first school leaving certificate (ESA), on the one hand, and the minimum standards for the secondary school leaving certificate (MSA), on the other. For those ninth-graders aspiring to achieve at least the MSA, the evaluations then also show, for the subject mathematics and the science subjects, the percentages of students who fall short of the minimum standards for the MSA, those who reach or exceed the normative standards for the MSA and those who reach the optimal standards for the MSA. The proficiencies achieved by ninth-graders enrolled in college-preparatory secondary schools [Gymnasien] are also reported.

The second focus of the evaluations is to address the extent to which the results have changed over time (trend), with results available for three survey dates: 2012, 2018 and 2024. The trend analyses focus on changes in the proficiency levels achieved by ninth-graders in the periods 2012–2018 and 2018–2024. A comparison of the results for these periods can offer indications of the extent to which changes identified between 2018 and 2024 may reflect the effects of restrictions on school operations during the coronavirus pandemic, or whether they might also represent a continuation of trends that had already begun between 2012 and 2018. Given the design of the study, however, it is not possible to ascribe changes that have occurred over time to specific causes in any clear way.[2]

Another analytical focus of the IQB studies relative to educational monitoring concerns the extent to which differences in students' proficiencies correlate with certain background characteristics. The study investigates differences in proficiency between gender groups (gender disparities), correlations

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1 The Standing Conference has now begun using the term "First school leaving certificate [Erster Schulabschluss]" (ESA) in lieu of the term "Lower secondary school leaving certificate" [Hauptschulabschluss]" (HSA). This change has been incorporated in the study report for the IQB Trends in Student Achievement 2024.

2 The IQB Trends in Student Achievement regularly provide an inventory of metrics indicative of the degree to which educational standards are being met. Therefore, the trend analyses are comparisons of the results of cross-sections of different cohorts of students. While these offer reliable indications of developments at a systemic level, they cannot be interpreted in a causal way. Changes are always the outcome of a complex interplay of a variety of conditions that might reflect not only the effects of crises such as the coronavirus pandemic but also changes in the composition of the student body, ongoing developments in curricular requirements, changes in school organization, etc.

between social background characteristics and the proficiency levels attained (social disparities) and performance differences between adolescents from immigrant families and adolescents without an immigration background (immigration-related disparities). While it is unrealistic to expect an educational system to completely reconcile dissimilar initial conditions, it remains a generally accepted aim of education policy to reduce the disparities associated with students' background characteristics to the greatest extent possible. With this in mind, a comparative review of the three surveys from 2012, 2018 and 2024 was conducted in an effort to identify the extent to which these disparities had evolved.

In addition to the subject-specific proficiencies the students achieved, the IQB Trends in Student Achievement 2024 consider further questions as well. The study report for the IQB Trends also presents evaluations of motivational characteristics (including subject-specific interests) and of the students' socio-emotional characteristics (including emotional problems, dealing with conflicts and social integration). Further supplemental analyses considered aspects of teaching structure, including the use of digital media, as well as a variety of characteristics of teachers' demographic background and qualifications, together with their assessments.

In what follows, after presenting some background information on the IQB Trends in Student Achievement 2024, we present figures and tables of the main results of the study along with a concise summary.

Proficiency tests and questionnaires

- In the subject mathematics, test items address the substantive areas of proficiency (core themes) of *numbers*, *measurement*, *space and shape*, *functional relations* as well as *data and chance*. A global scale summarizing all of the core themes that constitute mathematical proficiency was also created. The results reported in this summary relate exclusively to the global scale.
- The examination of the science subjects concerned itself with proficiencies in the areas of *subject knowledge* and *scientific inquiry*. The results presented in the summary are limited to the area of *subject knowledge*; the patterns of findings in the area of *scientific inquiry*, however, are usually very similar and are also factored into the statements made in the text.
- All of the test items were developed under the oversight of the IQB by teachers from throughout Germany who had been trained and advised by experts in teaching methodology and educational research. The test items were extensively tested prior to their use in the IQB Trends in Student Achievement.
- Following the tests, students completed a questionnaire. Questionnaires were also presented to the parents of the adolescents who took part in the study, to their mathematics and science teachers and to school administrators. The questionnaires for students and their parents offered a particularly useful source of information on the socio-demographic characteristics of adolescents and their families and on a variety of learning conditions that are central to the reporting.

Target population and sample

- The study IQB Trends in Student Achievement 2024 is designed to generate statements about students in the 9th grade, both throughout Germany as a whole and in the individual German states. The target population comprises all ninth-graders in regular schools, including schools for special education. The only students excluded from this target population are those with special educational needs in the area "mental development" and students who had received less than one year of instruction in German at the time the test was administered.

- To map the target population, a representative sample was generated based on a multi-stage, random selection process in which, for reasons of the feasibility of surveys under test conditions at special education schools, only children with special educational needs in the areas "learning," "language" and "emotional and social development" were considered.
- All in all, data from 48,279 ninth-graders in 1,556 schools were evaluated. Due to the test design – which provided items in the subject mathematics or the science subjects for only a sub-sample – calculations for the subject mathematics are based on the data of 27,268 students, and the analyses for the science subjects stem from the data of 27,501 students.

Participation rates[3]

- In public schools, participation in the proficiency tests for the IQB Trends in Student Achievement 2024 was mandatory. Participation in the tests was voluntary for some private schools, on the other hand, depending on the legal specifications in the states.
- Test sessions were carried out at a total of 98 percent of the schools selected for the sample in Germany as a whole. School participation is also high in the individual states, with participation rates of at least 93 percent in each state.
- The rate of student participation in the proficiency tests is around 91 percent in Germany as a whole, with rates of at least 88 percent in the individual states, although the rate for Hamburg stands at just approx. 80 percent.
- By contrast, rates of questionnaire participation for students and their parents are lower and vary more widely between states, as completing the questionnaires was voluntary for students in some states and for parents in all states. After combining key socio-demographic data from the survey of students and parents, these data being particularly important for the analyses of social and immigration-related disparities (e.g. parental occupation and education, the country of birth of adolescents and their parents), this portion of the survey resulted in a participation rate of roughly 84 percent nationwide. The rate was less than 80 percent in four states, however.
- As in 2012 and 2018, the reliability of the results with regard to social and immigration-related disparities in individual states is thus significantly limited in the IQB Trends in Student Achievement 2024 owing to a lack of responses. Consequently, reports of these results are incomplete or must be interpreted with caution. The results indicate which states and analyses are affected by this.

3 The rates of participation indicated here are weighted rates and reflect the proportion of the population represented by the sample.

2. Notes on the presentation and interpretation of the findings

Reporting metric (point scale)

- For all subjects and proficiency areas studied, the reporting metric was chosen in such a way that in 2012 it had a mean value of $M = 500$ points and a standard deviation of $SD = 100$ points in the overall population of ninth-graders in Germany.

Proficiency levels and their relationship to school leaving qualification

- The substantive interpretation of the students' test performance is based on models of proficiency levels that can be used to describe the requirements that students who have achieved a certain test result are in a position to fulfill.
- These models also make it possible to determine the extent to which adolescents' proficiency levels meet the targets defined in the educational standards and proficiency-level models in the respective subject and domain of proficiency (minimum standard, normative standard, normative standard plus, optimal standard). With this in mind, students' test scores (points scored) are assigned to the respective proficiency levels (cf. Tables 1.1 and 1.2).

Table 1.1: Proficiency-level models and standards in secondary level I in biology, chemistry and physics

Proficiency level	Test score			Standard MSA
	Biology Subject knowledge	**Chemistry Subject knowledge**	**Physics Subject knowledge**	
V	from 700	from 680	from 660	Optimal standard
IV	585 – 699	605 – 679	580 – 659	Normative standard plus
III	475 – 584	505 – 604	480 – 579	Normative standard
II	385 – 474	435 – 504	410 – 479	Minimum standard
I	below 385	below 435	below 410	
	Biology Scientific inquiry	**Chemistry Scientific inquiry**	**Physics Scientific inquiry**	
V	from 725	from 640	from 640	Optimal standard
IV	615 – 724	560 – 639	560 – 639	Normative standard plus
III	505 – 614	490 – 559	460 – 559	Normative standard
II	400 – 504	415 – 489	390 – 459	Minimum standard
I	below 400	below 415	below 390	

Notes. Educational standards and proficiency-level models for the MSA only are available for the science subjects. MSA = Secondary school leaving certificate.

Table 1.2: Integrated proficiency-level model and standards in secondary level I in mathematics

Proficiency level	Test score	Standard ESA	Standard MSA
V	from 675		Optimal standard
IV	595 – 674	Optimal standard	Normative standard plus
III	515 – 594	Normative standard plus	Normative standard
II	435 – 514	Normative standard	Minimum standard
I.b	355 – 434	Minimum standard	
I.a	below 355		

Notes. ESA = First school leaving certificate; MSA = Secondary school leaving certificate.

- For mathematics, in secondary level I, there are educational standards for two school qualifications; thus, a distinction must be made between proficiency expectations for the ESA and proficiency expectations for the MSA. Hence, the proficiency-level model for mathematics comprises different minimum, normative and optimal standards for these two qualifications.
- This is taken into account in the analyses that concern the subjec mathematics, first through an examination of the extent to which *all* ninth-graders of the respective target population a) meet the minimum standards for the ESA and b) meet the minimum standards for the MSA.[4]
- A second analytical step shows the extent to which the minimum, normative and optimal standards for the MSA are met in the subpopulation of ninth-graders who aspire to achieve at least the MSA (MSA population).[5]
- Only proficiency-level models for the MSA are available for the science subjects. Accordingly, attainment of educational standards is presented only for those students who aspire to the MSA or a higher qualification.
- All of the analyses of achievement of educational standards excluded ninth-graders with special educational needs who were pursuing an *alternative curriculum*, as they are subject to learning objectives different from those defined in the educational standards.

Mean proficiencies

- In addition to the analyses relating to proficiency levels, mean values were calculated based on the reporting metric (score scale) and indicate which proficiencies the students have acquired on average. Furthermore, dispersion measures were calculated to describe the degree of variance between students with respect to the proficiency levels achieved.
- The evaluations of the mean values and standard deviations of the proficiency levels achieved relate to the total population of ninth-grade students, including adolescents with special educational needs in regular schools and in schools for special education, regardless of whether the

4 The relevance of the minimum standards for the ESA stems from the fact that these standards comprise proficiency goals that *all* students should meet by the test date at the end of the 9th grade. Above and beyond this, it is helpful to study the rate of achievement of minimum standards for the MSA for all ninth-graders. In curricula that lead to the ESA, for example, it is often possible to acquire the MSA directly afterwards, which is increasingly viewed as a standard qualification. The ninth-graders tested as part of the IQB Trends in Student Achievement 2024 still have one year to meet the MSA standards, however. This should be taken into account when interpreting the results.

5 The advantage of this presentation is that it retains the relationship to the school leaving qualification, as only those students who actually aspire to the qualification of the MSA are measured against the requirements for the MSA. However, when interpreting state differences in these results, it should be noted that the share of students pursuing the MSA or a higher qualification varies between states.

instruction they received was based on educational standards or was provided in pursuit of other educational goals.

- Given the higher numbers of cases that underlie the individual significance tests in the comparisons of means, there are more differences in statistical significance involved in these analyses than in the comparisons of achievement of educational standards.
- The learning gains expected over the course of a school year can be enlisted to provide a substantive classification of differences in mean proficiencies. Corresponding estimates indicate that the increase in learning at the end of secondary level I between the 9th and 10th grades accounts for around 50 points in the reporting metric in the subject mathematics (*global scale*). For the proficiency area of *subject knowledge*, learning gains of about 20 points can be assumed in the subject biology, of around 35 points in the subject chemistry and of approx. 25 points in the subject physics.[6]
- Standardized mean differences or effect sizes (d) were also calculated. These create a context for the differences identified in two groups' common standard deviation. This indicator can be used to facilitate direct comparisons of group differences, even in the event of variation in the dispersion of values between the groups. There is a broad consensus that statistically significant differences with a value of $d = 0.20$ or more are not negligible.

Significance tests

- All of the parameters identified in the analyses are based on random samples. Accordingly, any conclusions about the overall target population always involve a certain degree of uncertainty.
- Statistically significant differences and trends are labeled as such in the results. Because most analyses are based on very large numbers of cases, even very small differences can reach a level of statistical significance. In analyses of small subpopulations, on the other hand, even relatively large differences may turn out not to be statistically significant.
- Even if no reliable interpretation is possible in the case of non-significant results, any signs of trends in patterns of results should not be ignored, particularly if major differences are found in different analyses.

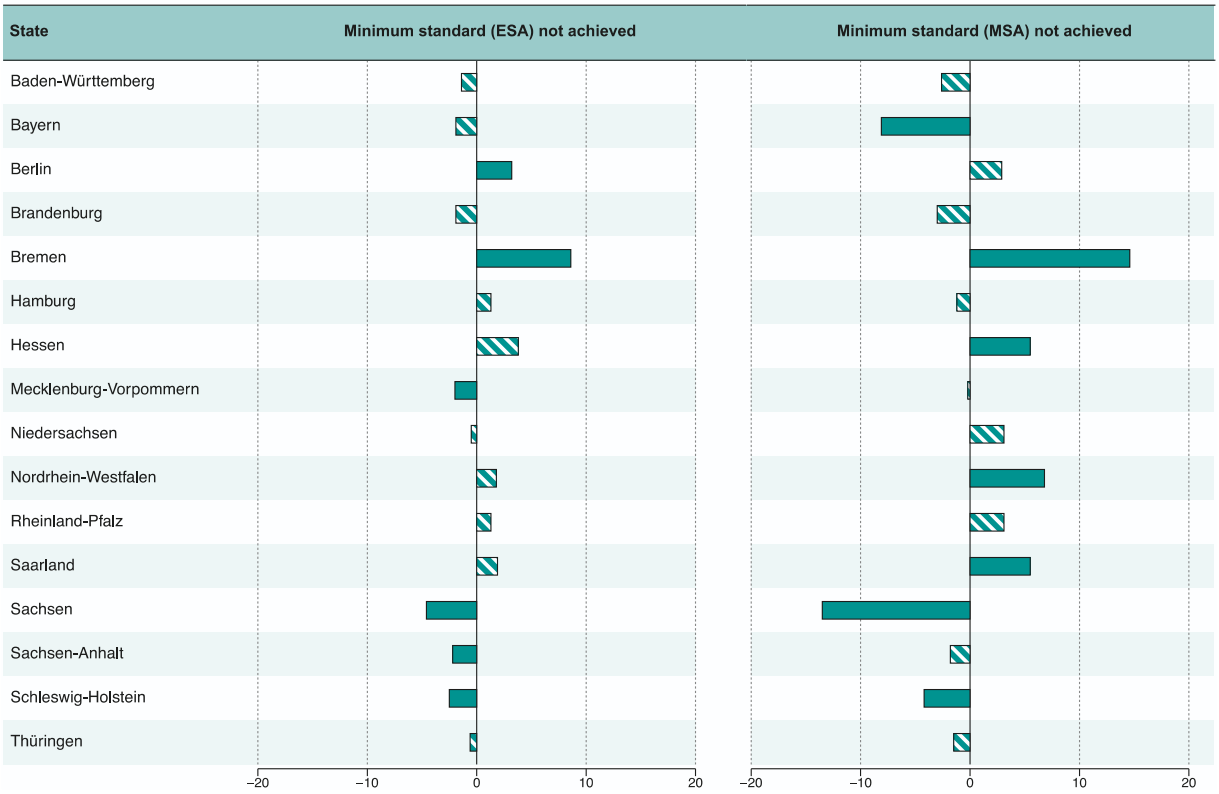
6 These values only provide a rough orientation, however. It should be pointed out specifically that learning gains over the course of secondary level I are not constant. On average, then, it is safe to expect to see greater learning gains at the beginning of secondary level I than at the end of secondary level I.

3. Achieving the educational standards in the states

3.1 Achieving the educational standards in 2024

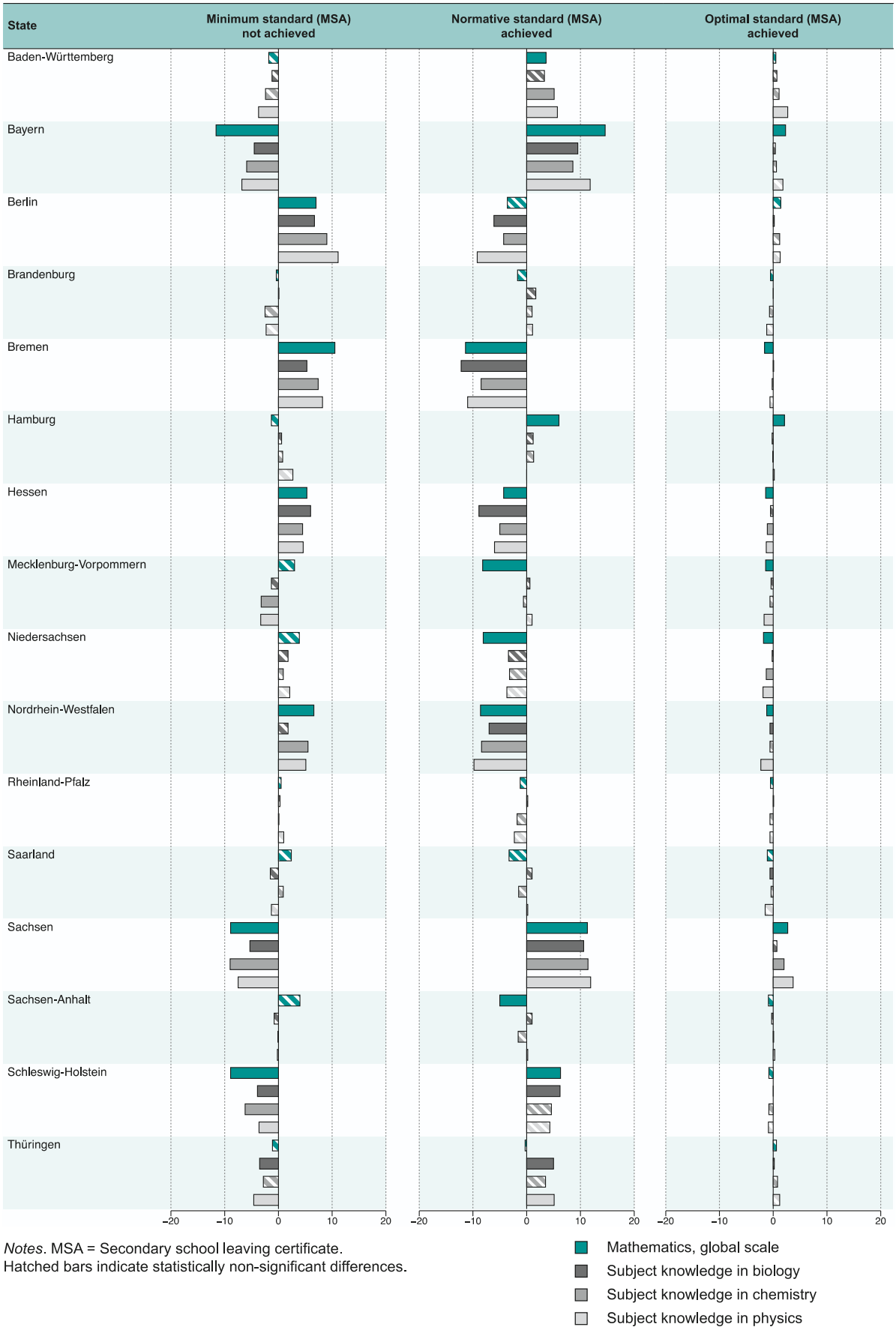
- In the subject mathematics (*global scale*), roughly 9/34 percent of all ninth-graders (**total population**) fall short of the minimum standard for the ESA/MSA. Among the **MSA population**, the proportion of students who fall short of the minimum standard for the MSA is just under 24 percent; nearly 42 percent of students reach or exceed the normative standard for the MSA.
- In the scientific subjects, within the **MSA population**, roughly 10 percent of students in biology, 25 percent of students in chemistry and 16 percent of students in physics do not meet the minimum standard for the MSA (*subject knowledge* in each case). The proportion of ninth-graders who meet or exceed the normative standard for the MSA stands at around 59 percent (biology), 45 percent (chemistry) and 57 percent (physics).
- Figure 3.1 provides an overview of the extent to which, among the total population of ninth-graders, the percentages of students in the individual states who fall short of the minimum standard for the ESA or MSA in the subject mathematics differ from the respective share for Germany as a whole. Figure 3.2 presents the results for mathematics and the science subjects for the MSA population, here indicating the percentages of students who fall short of the minimum standards for the MSA, who meet or exceed the normative standards for the MSA or who meet the optimal standards. Bars that point to the right indicate that the percentage in the respective state is greater than in Germany as a whole; if a bar points to the left, the percentage for the state in question is lower than the nationwide percentage.
- In mathematics, the states of Bayern, Sachsen and Schleswig-Holstein have particularly strong results when compared to Germany as a whole. Particularly weak results in the subject mathematics are registered almost uniformly in Bremen, Hessen and Nordrhein-Westfalen. Individual results for some of the other states also differ significantly from the respective value for Germany as a whole, but the patterns here are less clear-cut than in the states mentioned.
- As for the science subjects, the results for the **MSA population** in Bayern and Sachsen are largely significantly better than for Germany as a whole. Results in multiple areas of proficiency that significantly exceed the nationwide level can be seen in Baden-Württemberg, Schleswig-Holstein and Thüringen as well. In the states of Berlin, Bremen, Hessen and Nordrhein-Westfalen, on the other hand, deviations from the scores for Germany as a whole are predominantly unfavorable.

Figure 3.1: Percentages of ninth-graders in the states in 2024 falling short of the minimum standard for the ESA or the minimum standard for the MSA in the subject mathematics, expressed as a deviation from the respective percentage for Germany as a whole



Notes. ESA = First school leaving certificate; MSA = Secondary school leaving certificate.
Hatched bars indicate statistically non-significant differences.

Figure 3.2: Percentages of ninth-graders in the states in 2024 aspiring to at least the MSA and falling short of the minimum standard for the MSA, reaching or exceeding the normative standard for the MSA or reaching the optimal standard for the MSA, expressed as a deviation from the respective percentage for Germany as a whole

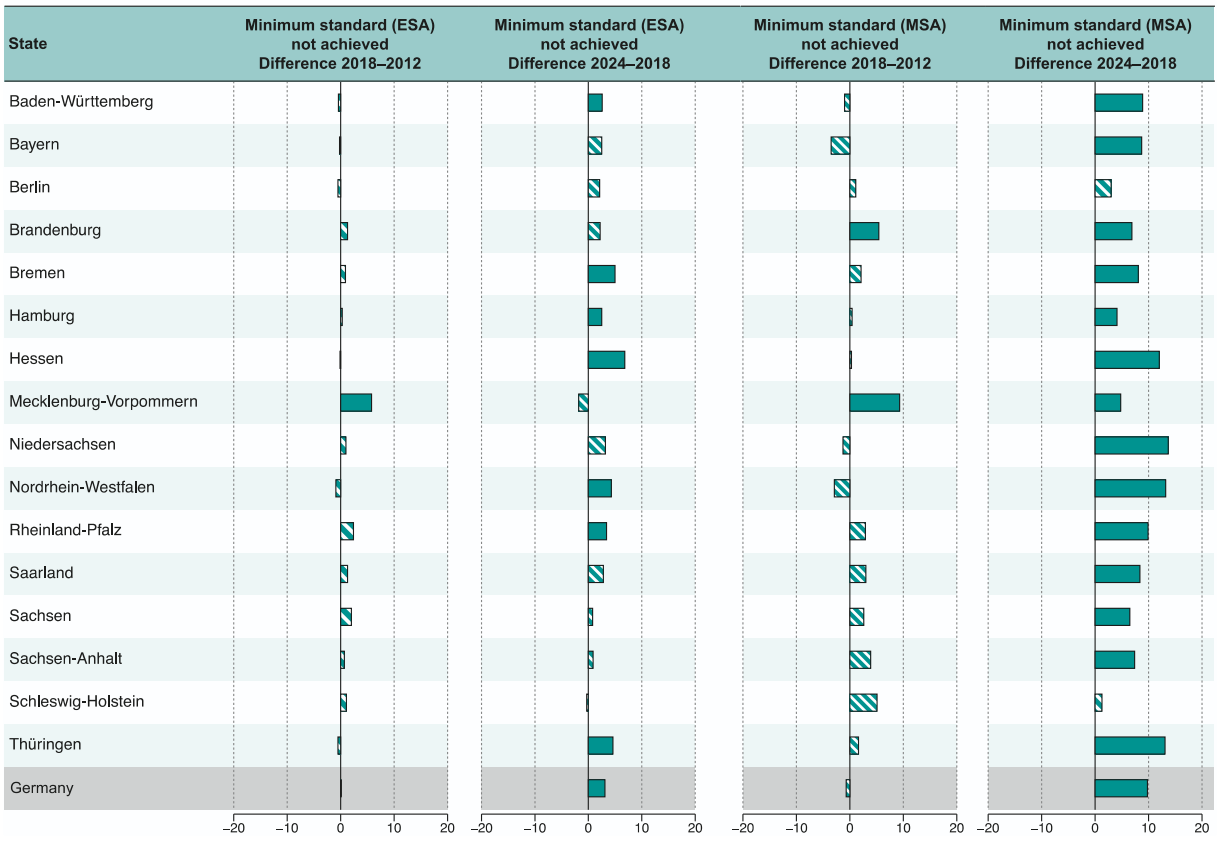


Notes. MSA = Secondary school leaving certificate.
Hatched bars indicate statistically non-significant differences.

3.2 Changes in achievement of the educational standards (trends)

- Figures 3.3 through 3.5 show the trend results for the periods 2012–2018 and 2018–2024. Bars pointing to the right indicate that the percentage of adolescents who fall short of or meet the corresponding standard in the respective state has increased during the period in question, while bars that point to the left indicate a decrease in that percentage.
- All in all, there are unfavorable nationwide trends to report in mathematics and scientific subjects in the 2018–2024 period; these trends affect all of the states, but to varying degrees.
- In the subject mathematics (*global scale*), the share of ninth-graders in the **overall population** who fall short of the minimum standard for the ESA / MSA was significantly higher and rose by approx. 3 / 10 percentage points between 2018 and 2024. In the **MSA population**, the share of students falling short of the minimum standard for the MSA was significantly higher, rising by approximately 9 percentage points, and the share of ninth-graders meeting or exceeding the normative standard for the MSA dropped significantly, by nearly 12 percentage points.
- In the science subjects, the share of students in the **MSA population** who fell short of the minimum standard for the MSA was significantly higher, rising by some 5 percentage points in the subject biology, by 9 percentage points in the subject chemistry and by 7 percentage points in the subject physics during the 2018–2024 period (in terms of *subject knowledge* in each case). The shares of adolescents meeting or exceeding the normative standard for the MSA fell significantly, dropping 11 to 12 percentage points in the three subjects.
- The share of adolescents in the **MSA population** who met the optimal standards in mathematics and the natural sciences also revealed a significant decline in Germany between 2018 and 2024.

Figure 3.3: Changes in the percentage shares of ninth-graders in the states falling short of the minimum standard for the ESA or the minimum standard for the MSA in the subject mathematics



Notes. ESA = First school leaving certificate; MSA = Secondary school leaving certificate.
Hatched bars indicate statistically non-significant differences.

Figure 3.4: Changes in the percentages of ninth-graders in the states striving to achieve at least the MSA and falling short of the minimum standard for the MSA, or reaching or exceeding the normative standard for the MSA

Notes. MSA = Secondary school leaving certificate.
Hatched bars indicate statistically non-significant differences.

Figure 3.5: Changes in the percentages of ninth-graders in the states striving to achieve at least the MSA and reaching the optimal standard for the MSA

Notes. MSA = Secondary school leaving certificate.
Hatched bars indicate statistically non-significant differences.

4. Mean proficiencies

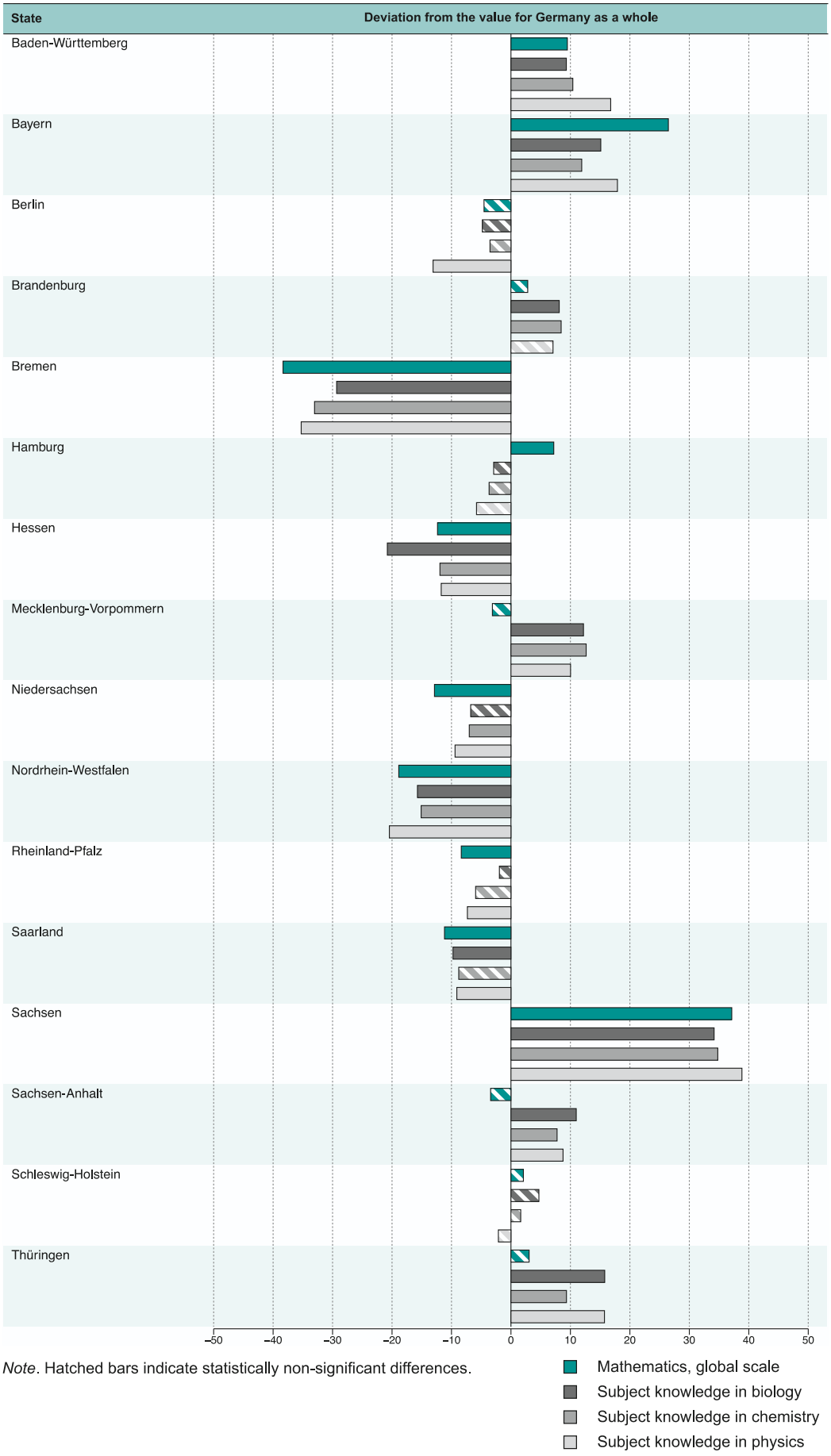
4.1 Mean proficiencies achieved in 2024

- In the subject mathematics, the average proficiency scores achieved in Germany totaled 474 points in 2024. The mean score in the subject biology stood at 473 points, alongside 471 points in the subject chemistry and 474 points in the subject physics.
- Figure 4.1 shows the extent to which students' mean proficiency scores in the individual states deviate from the Germany-wide mean for 2024. As expected, the patterns in the results quite closely resemble those for achieving the educational standards (cf. Section 3); this effect is even more striking for the mean values.
- Consistently significant positive deviations from the respective national average are recorded in Baden-Württemberg, Bayern and Sachsen. The science subjects exhibit relative strengths across all the states in eastern Germany: Mean proficiency scores that significantly exceed the national average were seen in all three scientific subjects not only in Sachsen, but also in Mecklenburg-Vorpommern, Sachsen-Anhalt and Thüringen; similarly high levels in biology and chemistry were found in Brandenburg as well. The levels of proficiency achieved in Hamburg in mathematics were also significantly higher than the German mean.
- By contrast, mean values are significantly lower than the national mean across the board in Bremen, Hessen and Nordrhein-Westfalen and nearly across the board in Saarland. The states of Niedersachsen (mathematics, chemistry, physics) and Rheinland-Pfalz (mathematics, physics) presented significantly lower means in multiple subjects compared to Germany as a whole.

Adjusted means

- As in previous IQB Trends in Student Achievement, the IQB Trends in Student Achievement 2024 calculated adjusted mean values; this accounts for differences in the composition of the student body between the states and for differences between the survey dates.
- If, on average, central background characteristics (family socioeconomic status and cultural capital, immigration background, family language) were as pronounced in all states in 2024 as in Germany as a whole, the mean values for the states would tend to converge somewhat more closely. Such an adjustment only has a substantial impact in individual states, however.

Figure 4.1: Deviations from the German national mean of the mean proficiency scores achieved by ninth-grade students in 2024 in the states (in points on the reporting metric)



Note. Hatched bars indicate statistically non-significant differences.

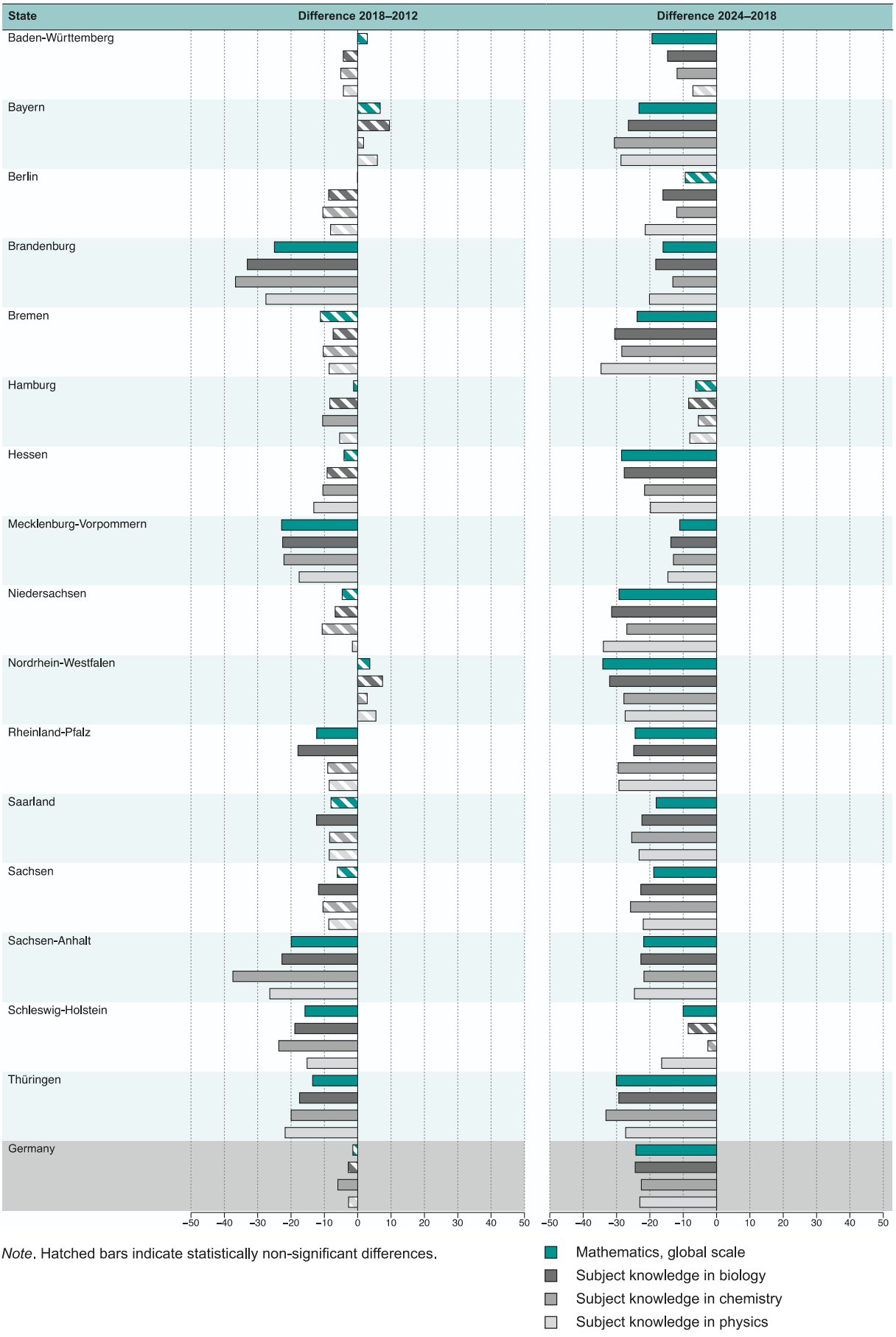
4.2 Changes in mean proficiencies (Trends)

- Figures 4.2 (**overall population**) and 4.3 (**ninth-graders in college-preparatory secondary schools [Gymnasien]**) present the trend results for average proficiency scores during the periods 2012–2018 and 2018–2024.
- In the subject mathematics, there was a significant downturn of 24 points in the mean level of proficiency for the **overall population** in Germany during the period 2018–2024, and of 26 points among the ninth-graders in **college-preparatory secondary schools**.
- The results observable in the science subjects are similar. Here, the mean scores achieved in Germany overall in 2024 are significantly lower than in 2018; they are 23 to 24 points lower across the overall population and 22 to 25 points lower in college-preparatory secondary schools.
- Significant downward trends can also be seen in the overall population across nearly all the states during the 2018–2024 period, as well as among ninth-graders in the subject mathematics and in the science subjects at college-preparatory secondary schools.
- There were only few significant changes or none at all in the average level of proficiency across the entire population nationwide and in most of the states between 2012 and 2018. Significant downward trends across all subjects could already be seen at college-preparatory secondary schools throughout Germany during this period, but these were less pronounced than between 2018 and 2024.

Adjusted trends

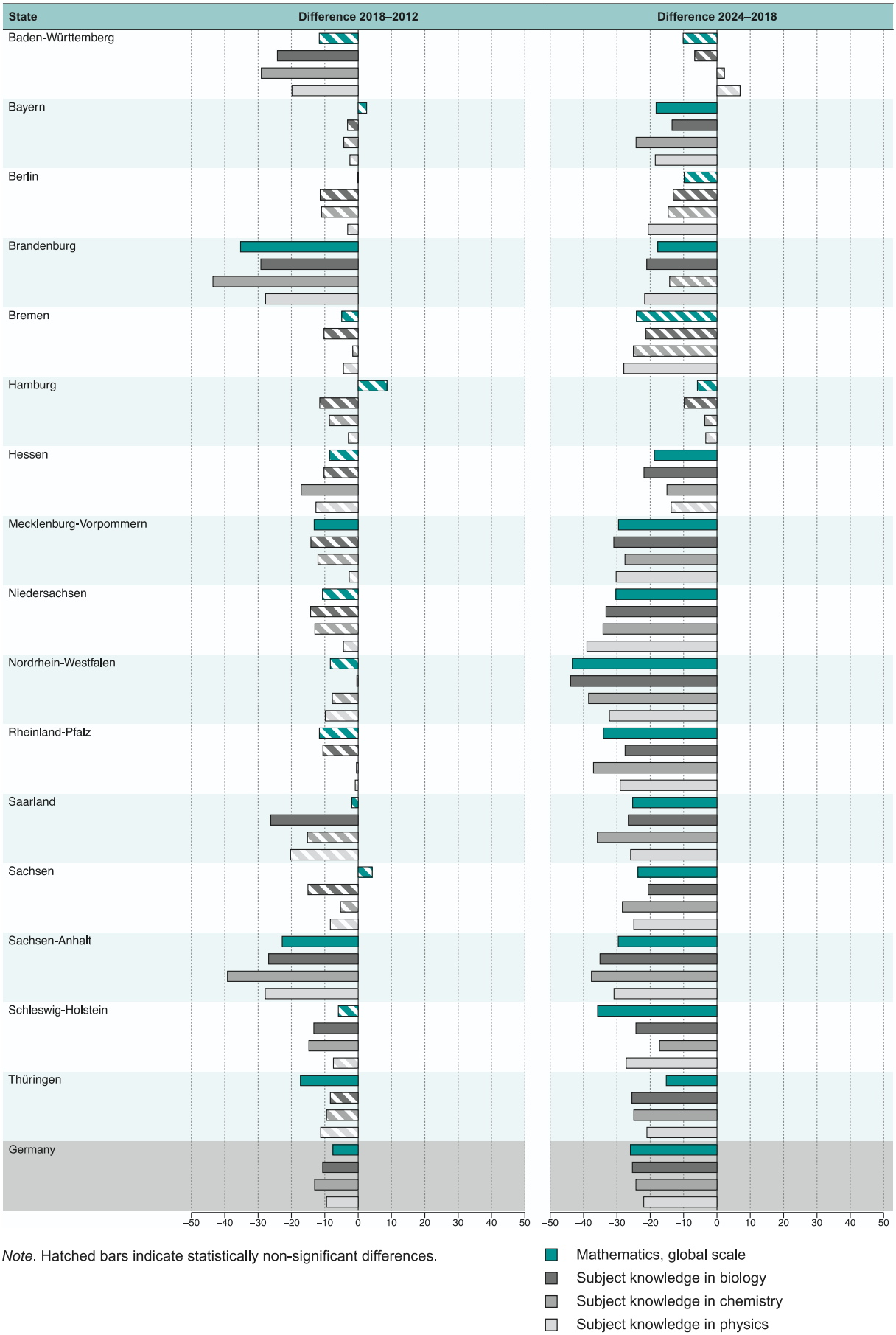
- The negative trends in the subject mathematics and the science subjects could have been expected even in the absence of changes in key background characteristics (family socioeconomic status and cultural capital, immigration background, family language) within the states between the survey dates 2018 and 2024. Only some of the previously significant trends are no longer significant after the adjustment.
- Accordingly, in none of the states can the trends be attributed entirely to changes in the composition of the student body.

Figure 4.2: Changes in ninth-grade students' mean proficiency scores in each state (in points on the reporting metric)



Note. Hatched bars indicate statistically non-significant differences.

Figure 4.3: Changes in mean proficiency scores among ninth-grade students enrolled in college-preparatory secondary schools [Gymnasien] in each state (in points on the reporting metric)



Note. Hatched bars indicate statistically non-significant differences.

5. Gender disparities

Differences in proficiencies of girls and boys in 2024

- There is a strong overlap in the distributions of proficiencies of girls and boys. At the same time, there are significant differences in the mean values achieved by girls and boys across nearly all of the subjects and proficiency areas studied (cf. Fig. 5.1).
- The mean scores for boys in mathematics are almost always higher than for girls. On the *global scale*, boys' lead in proficiency totals 12 points.
- Girls nearly always achieve higher mean levels of proficiency than boys in the scientific subjects biology, chemistry and physics. At 21 points, girls' proficiency lead is the most pronounced in *subject knowledge* in biology.
- At college-preparatory secondary schools [Gymnasien], the disparities shift in favor of the boys; there, their lead in mathematics and their disadvantage in the science subjects is more narrow than across the overall population.
- In the states, the results for the subjects mathematics and biology are similar to those for Germany as a whole. There are no significant gender differences observable in most of the states in the subjects chemistry and physics, on the other hand.

Trends in the proficiencies achieved by girls and boys

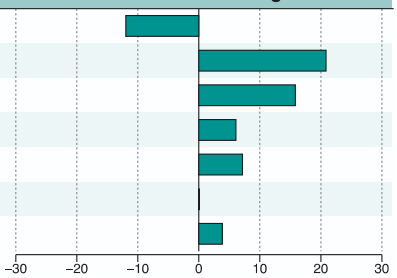
- Girls and boys are similarly affected by the negative trends seen between 2018 and 2024 (cf. Section 4).
- Most of the nationwide patterns in the findings can also be seen at the state level, albeit with some exceptions (especially for boys in the area of *scientific inquiry* in biology).

Trends in gender disparities

- Whereas gender-related disparities in mathematics decreased significantly over the 2012–2018 period, they have not changed significantly in Germany as a whole over the 2018–2024 period or in nearly all the states.
- In the science subjects, gender-related disparities remained largely unchanged across both periods in Germany as a whole. Significant changes were seen only in individual states.

Figure 5.1: Proficiency differences between boys and girls in the subjects mathematics, biology, chemistry and physics for Germany as a whole

	Girls		Boys		Difference girls–boys		Advantage in favor of the boys / girls
	M	*SD*	*M*	*SD*	Δ*M*	*d*	
Mathematics global scale	468	94.9	480	97.8	**–12**	**–0.12**	
Biology subject knowledge	484	93.7	463	95.9	**21**	**0.22**	
Biology scientific inquiry	485	98.7	469	102.1	**16**	**0.16**	
Chemistry subject knowledge	475	91.7	469	94.4	**6**	**0.06**	
Chemistry scientific inquiry	477	92.1	470	95.0	**7**	**0.08**	
Physics subject knowledge	475	96.1	474	98.5	0	0.00	
Physics scientific inquiry	479	95.6	475	98.0	**4**	**0.04**	



Notes: The indicated values are rounded. As a result, the difference in mean values may deviate slightly from the difference presented (Δ*M*).
M = mean; *SD* = standard deviation; Δ*M* = difference in means between girls and boys; *d* = effect size Cohen's *d*.
Differences printed in bold type are statistically significant ($p < .05$). Hatched bars indicate statistically non-significant differences.

6. Social disparities

Socioeconomic status

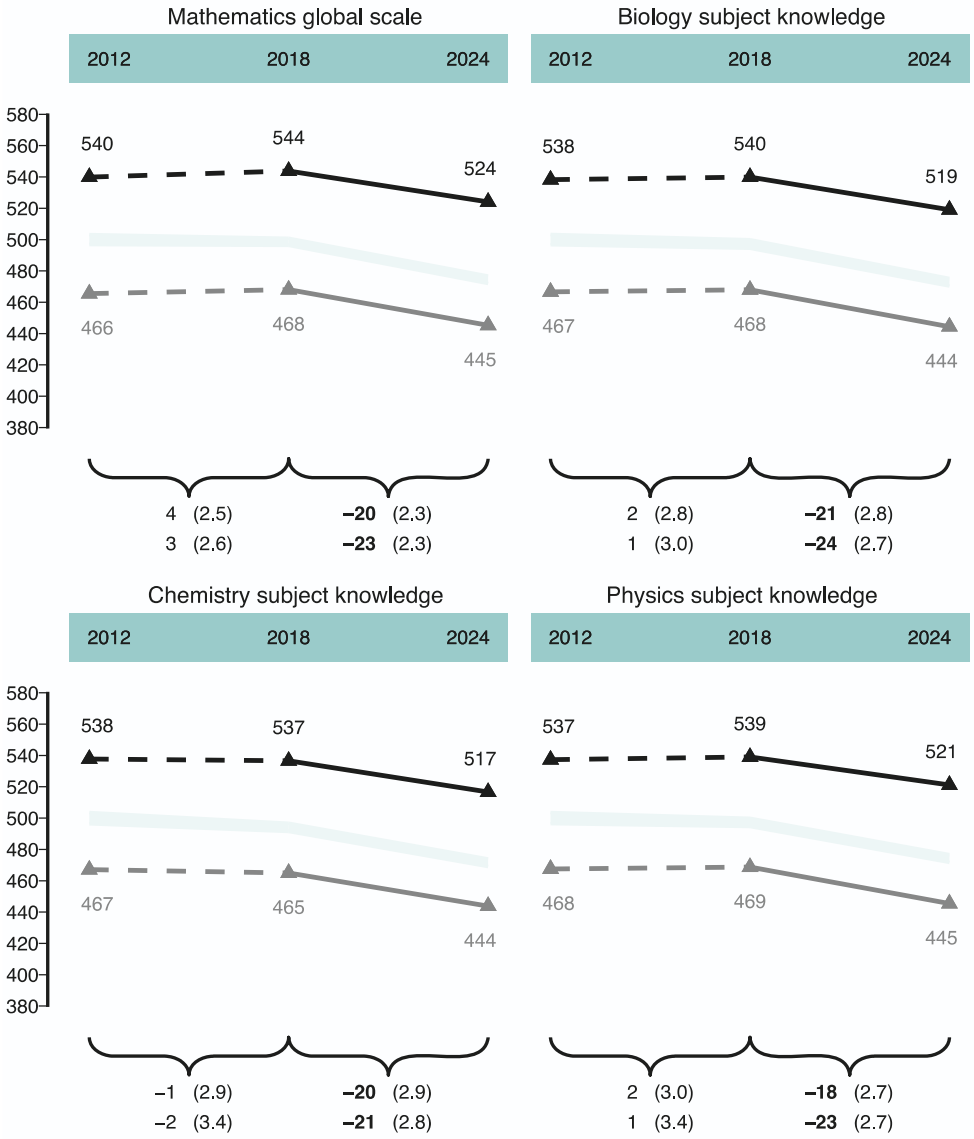
- The average socioeconomic status of ninth-graders and their parents nationwide was slightly higher in 2024 than in 2018 – a development already seen to a similar extent between 2012 and 2018. The dispersion of scores increased slightly between 2018 and 2024, however, in contrast to the 2012–2018 period, suggesting increasing differences in socioeconomic status.
- The correlation between the proficiency levels achieved by ninth-graders and their families' socioeconomic status, based on the social gradient,[7] is substantial across all areas of proficiency, both in Germany as a whole and in all of the states. Students from families with a higher socioeconomic status thus achieve higher average levels of proficiency.
- The trend in Germany overall is that there has not been a significant change in social gradients between 2018 and 2024. A comparable pattern of findings was already discernible for the 2012–2018 period.
- Social gradients held largely steady across both study periods in the states as well.

Cultural capital

- The number of books available in the adolescents' households again served as an indicator of families' cultural capital. The share of ninth-graders living in households with more than 100 books declined between 2018 and 2024. A significant decline could already be observed between 2012 and 2018.
- Cultural capital is closely related to the proficiencies achieved. This is the case both throughout Germany as a whole and in all of the states. On average, students who grow up in households with larger holdings of books achieve substantially higher proficiency scores in all areas of proficiency (cf. Fig. 6.1); depending on the subject and proficiency area involved, the difference ranges from 72 to 80 points nationwide against the reporting metric.
- The disparities associated with cultural capital have held largely steady at a high level nationwide between 2018 and 2024 and between 2012 and 2018.
- The downturn in proficiencies thus affects adolescents from socially privileged families to about the same extent as adolescents from families with lower levels of social privilege.

7 Social gradients describe the linear relationship between family socioeconomic status and the proficiency levels that students achieved, with higher values indicating closer correlation between the two. More detailed information on the interpretation of social gradients can be found in Section 6 of the report.

Figure 6.1: Mean proficiency scores by number of books in the household in 2012, 2018 and 2024 in Germany as a whole



Notes. The indicated values are rounded. As a result, the difference in mean values may deviate slightly from the difference presented (Δ*M*) under the curly bracket. The sequence shown in color marks the trend for all ninth-graders in Germany as a whole (mean +/- standard error).
[a] Trend differs statistically significantly ($p < .05$) from the trend for all ninth-graders in Germany as a whole.
Differences printed in bold type are statistically significant ($p < .05$).

- more than 100 books in the household (Δ*M* first line under the bracket)
- maximum of 100 books in the household (Δ*M* second line under the bracket).
- ● value does not differ statistically significantly from the value for all ninth-graders in Germany as a whole
- ▲ value differs statistically significantly ($p < .05$) from the value for all ninth-graders in Germany as a whole
- statistically non-significant difference between the survey dates of 2012 and 2018 as well as 2018 and 2024
- statistically significant difference ($p < .05$) between the survey dates of 2012 and 2018 as well as 2018 and 2024
- difference between the survey dates 2012 and 2018 as well as 2018 and 2024

7. Immigration-related disparities

Adolescents with and adolescents without an immigration background in the states

- In Germany as a whole, the proportion of young people from immigrant families (at least one parent not born in Germany) increased by almost 7 percentage points in both the 2012–2018 and 2018–2024 periods (cf. Table 7.1).
- This proportion stands at approx. 40 percent nationwide in 2024; it varies widely at the state level and is still significantly lower in the eastern German states than in the city-states and the western German states.
- The 2018–2024 period saw a particular increase in the share of first-generation adolescents[8], which rose by 7 percentage points and reached 13 percent in 2024. The proportion of second-generation adolescents, on the other hand, has not changed significantly and stands at around 14 percent in 2024.
- Some 33 percent of the first generation, or 5 percent of ninth-graders overall, came to Germany as refugees.

Immigration-related disparities in the proficiencies achieved

- In 2024, there are significant proficiency disadvantages across all subjects studied for students from immigrant families; these disadvantages are particularly pronounced among first-generation immigrants (cf. Fig. 7.1).
- Regardless of immigration background, the proficiency level compared to 2018 decreased significantly across Germany for all ninth-graders in the subject mathematics (cf. Fig. 7.2). There are also significant downward trends within most states for students with no immigration background; this is true only in some of the states for students with an immigration background[9]. There has been no statistically significant shift in immigration-related disparities in mathematics since 2018, whether considered nationwide or in most of the states.
- The science subjects (cf. Fig. 7.2) reveal downward trends for students without an immigration background and for their second-generation counterparts throughout Germany as a whole for the 2018–2024 period. The proficiencies seen among the first generation of immigrants have held largely steady, albeit at a relatively low level. Consequently, there was no significant shift in immigration-related disparities for second-generation adolescents during the 2018–2024 period, while these disparities decreased significantly among first-generation students.
- Within the states, the majority of pupils with no immigration background have seen their proficiency levels in science subjects significantly reduced since 2018. For students with an immigration background, in contrast, these levels have fallen significantly in fewer than half of the states and have otherwise held largely steady. There has likewise been no significant shift in immigration-related disparities in the natural sciences in most of the states.

8 The term “first generation” refers to adolescents who themselves, along with their parents, were born abroad. The term “second generation” describes adolescents born in Germany to foreign-born parents.

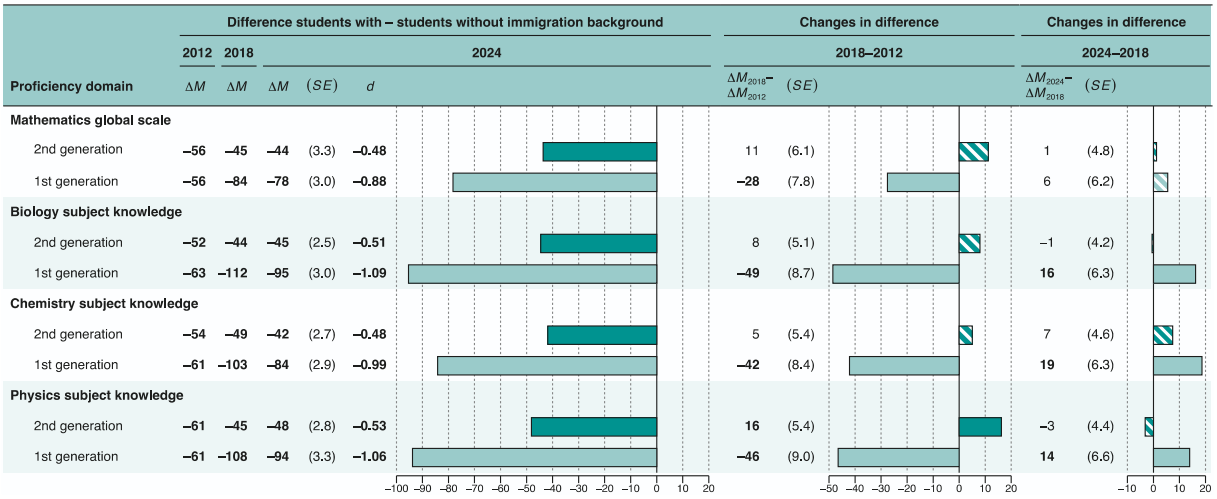
9 For trend analyses at the state level, where the number of cases occasionally proved too low, first- and second-generation adolescents were combined to create a single group of adolescents with an immigration background.

Table 7.1: Percentages of ninth-grade students with and without an immigration background in the states in 2024 and changes since 2012 and 2018

State	Without an immigration background	With an immigration background total[1]			One parent born abroad			2nd generation			1st generation			Not assignable
			2018–2012	2024–2018		2018–2012	2024–2018		2018–2012	2024–2018		2018–2012	2024–2018	
	valid %[2]	valid %[2]	+/–	+/–	valid %[2]	+/–	+/–	valid %[2]	+/–	+/–	valid %[2]	+/–	+/–	%
Baden-Württemberg[3]	51.0	49.0	**13.4**	**6.9**	17.9	**3.2**	**2.6**	16.8	**7.4**	**-3.4**	14.3	**2.8**	**7.7**	4.9
Bayern[3]	62.0	38.0	3.9	**9.6**	13.4	1.2	2.0	11.5	1.6	-0.1	13.0	1.0	**7.8**	14.7
Berlin	46.6	53.4	-	**6.7**	18.6	-	-0.6	17.3	-	-1.0	17.6	-	**8.2**	8.7
Brandenburg	82.2	17.8	**3.9**	**5.9**	7.1	-0.2	**2.1**	2.5	**1.3**	0.1	8.3	**2.9**	**3.7**	3.5
Bremen[3]	38.7	61.3	-	**11.9**	17.4	-	2.1	20.4	-	-4.0	23.6	-	**13.8**	8.7
Hamburg[3,5]	47.8	52.2	-	-	17.0	-	-	20.0	-	-	15.1	-	-	8.4
Hessen	48.1	51.9	**8.0**	**8.0**	14.6	1.9	0.1	19.4	2.0	-0.6	17.9	**4.1**	**8.5**	7.7
Mecklenburg-Vorpommern[3]	85.6	14.4	1.5	**5.0**	4.5	-0.6	**1.4**	1.9	0.5	0.1	8.0	1.6	**3.5**	3.8
Niedersachsen	63.2	36.8	**10.5**	3.6	10.0	**2.7**	-1.4	13.5	3.4	-0.5	13.3	**4.4**	**5.5**	4.4
Nordrhein-Westfalen[3,4,5]	52.1	47.9	**4.6**	**10.0**	14.6	**2.3**	0.7	19.0	1.0	0.7	14.3	1.4	**8.6**	18.3
Rheinland-Pfalz[3,4,5]	59.6	40.4	**8.4**	**7.1**	12.4	1.7	0.6	14.6	**4.0**	-0.7	13.3	**2.7**	**7.2**	20.6
Saarland[4,5]	59.9	40.1	-	**7.5**	11.8	-	0.6	13.1	-	-0.5	15.1	-	**7.4**	24.8
Sachsen	88.2	11.8	1.6	0.3	4.6	-0.3	-0.7	3.1	**1.2**	0.4	4.2	0.7	0.6	12.7
Sachsen-Anhalt	85.7	14.3	**5.7**	1.8	4.3	0.9	-0.5	2.5	**1.5**	-0.3	7.6	**3.3**	2.5	3.5
Schleswig-Holstein[3,4]	71.0	29.0	**5.2**	**6.9**	10.0	1.9	0.3	8.3	1.1	0.5	10.7	**2.3**	**6.1**	4.2
Thüringen	85.2	14.8	2.3	**4.8**	4.7	-0.9	0.9	2.0	1.0	-0.3	8.1	**2.2**	**4.2**	3.1
Germany[3]	60.1	39.9	**6.7**	**6.8**	12.9	**1.9**	0.7	13.8	**2.4**	-0.8	13.2	**2.3**	**6.9**	11.0

Notes. The indicated values are rounded. As a result, the sum of the percentages may deviate slightly from 100, and the difference in percentages may deviate slightly from the difference shown in the +/− column.
+/– = Change compared to the IQB National Assessment 2012 / IQB Trends in Student Achievement 2018. No results can be reported for Berlin, Bremen, Hamburg or Saarland, as the information required for several of the survey dates is missing for more than 30% of the students.
Without an immigration background: Both parents were born in Germany.
2nd generation: Both parents are foreign-born, and the student was born in Germany.
1st generation: Both parents and the student are foreign-born.
[1] includes students with a parent born abroad, students of the 2nd generation and students of the 1st generation.
[2] valid % = Percentages are based only on information from the students that can be clearly assigned.
The findings for year [3]2012, [4]2018 and [5]2024 should be interpreted with caution due to the large percentage of missing data (20–30 percent).
Differences printed in bold type are statistically significant ($p < .05$).

Figure 7.1: Differences in mean procifiencies achieved by students with and without an immigration background in 2012, 2018 and 2024 compared to Germany as a whole

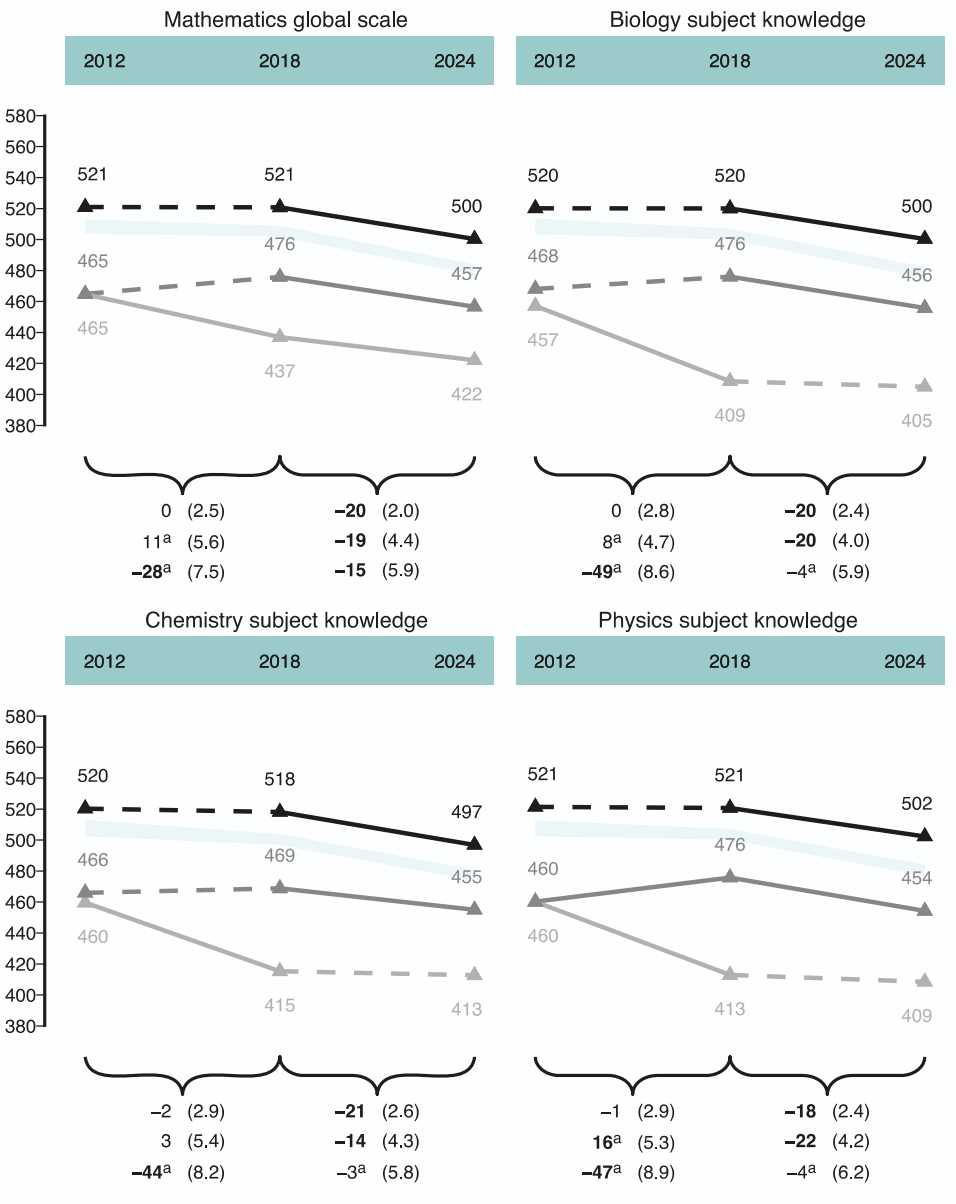


Notes. The indicated values are rounded. As a result, the difference in values may deviate slightly from the difference presented (Δ *M*).
Δ*M* = difference between students with and students without an immigration background; *SE* = standard error of the mean difference; *d* = effect size Cohen's *d*; ΔM_{2018}–ΔM_{2012}/ΔM_{2024}–ΔM_{2018} = change in the difference between students with and students without an immigration background. For the respective survey year, negative values and left-pointing bars indicate lower proficiency levels for students with an immigration background. In the trend, negative values and left-pointing bars indicate an increase in proficiency disadvantages among students with an immigration background.
2nd generation: Both parents are foreign-born, and the student was born in Germany.
1st generation: Both parents and the student are foreign-born.
Differences printed in bold type are statistically significant ($p < .05$). Hatched bars indicate statistically non-significant differences.

Correlations of immigration-related disparities with family background characteristics and learning conditions

- Analyses performed for Germany as a whole show that a significant share of the immigration-related disparities in 2024 are attributable to the lower average socioeconomic and cultural capital of the families of adolescents with an immigration background.
- Differences in students' command of German also help explain differences in proficiencies between adolescents without an immigration background and adolescents with an immigration background. This once again underscores the importance of efforts to foster language development.
- Among students with a refugee biography, in 2024 the average proficiency level is lower across all of the subjects considered here than the proficiency level of their first-generation classmates with no refugee experience. The proficiency differences between these two groups are also considerably reduced, and in some cases no longer significant at all, if, in addition to differences in socioeconomic background and cultural capital, differences in German skills are statistically monitored as well.

Figure 7.2: Comparison of mean proficiencies achieved in the subjects mathematics, biology, chemistry and physics by students without an immigration background in Germany as a whole in 2012, 2018 and 2024



Notes. The indicated values are rounded. As a result, the difference in mean values may deviate slightly from the difference presented (Δ*M*) under the curly bracket. The sequence shown in color marks the trend for all ninth-graders in Germany as a whole (mean +/- 2 standard errors).

[a] Trend differs statistically significantly ($p < .05$) from the trend for all ninth-graders in Germany as a whole.

Differences printed in bold type are statistically significant ($p < .05$).

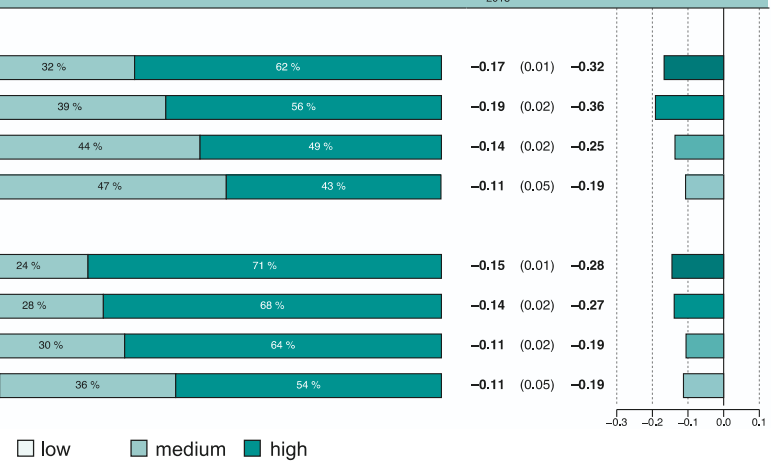
- without an immigration background (Δ*M* first line under the bracket): Both parents were born in Germany.
- 2nd generation (Δ*M* second line under the bracket): Both parents are foreign-born, and the student was born in Germany.
- 1st generation (Δ*M* third line under the bracket): Both parents and the student are foreign-born (including refugee students).
- ● value does not differ statistically significantly from the value for all ninth-graders in Germany as a whole
- ▲ value differs statistically significantly ($p < .05$) from the value for all ninth-graders in Germany as a whole
- statistically non-significant difference between the survey dates 2012 and 2018 as well as 2018 and 2024
- statistically significant difference ($p < .05$) between the survey dates 2012 and 2018 as well as 2018 and 2024
- difference between the survey dates 2012 and 2018 as well as 2018 and 2024

School satisfaction and social integration

- The school satisfaction and social integration of students with and without immigration backgrounds have decreased somewhat and in equal measure since 2018. Still, both characteristics of school affiliation remain highly pronounced overall in 2024 (cf. Fig. 7.3).
- These values are slightly less pronounced among adolescents with refugee experience than among adolescents without refugee experience; on average, however, they also report satisfaction with their school and a sense of being socially integrated at school.

Figure 7.3: Mean values and standard deviations of school satisfaction and social integration and group differences by immigration background in 2024 and changes since 2018

Characteristics	2024 *M*	*SD*	Δ*M*	(*SE*)	*d*	Difference 2024–2018 $M_{2024}-M_{2018}$	(*SE*)	*d*
General school satisfaction								
without immigration background	3.02	0.54				**–0.17**	(0.01)	**–0.32**
2nd generation	2.97	0.54	**–0.06**	(0.01)	**–0.10**	**–0.19**	(0.02)	**–0.36**
1st generation	2.90	0.55	**–0.12**	(0.01)	**–0.22**	**–0.14**	(0.02)	**–0.25**
Refugees	2.82	0.57	**–0.20**	(0.03)	**–0.36**	**–0.11**	(0.05)	**–0.19**
Social integration								
without immigration background	3.12	0.53				**–0.15**	(0.01)	**–0.28**
2nd generation	3.10	0.51	–0.02	(0.01)	–0.03	**–0.14**	(0.02)	**–0.27**
1st generation	3.04	0.56	**–0.08**	(0.01)	**–0.15**	**–0.11**	(0.02)	**–0.19**
Refugees	2.92	0.62	**–0.20**	(0.03)	**–0.35**	**–0.11**	(0.05)	**–0.19**



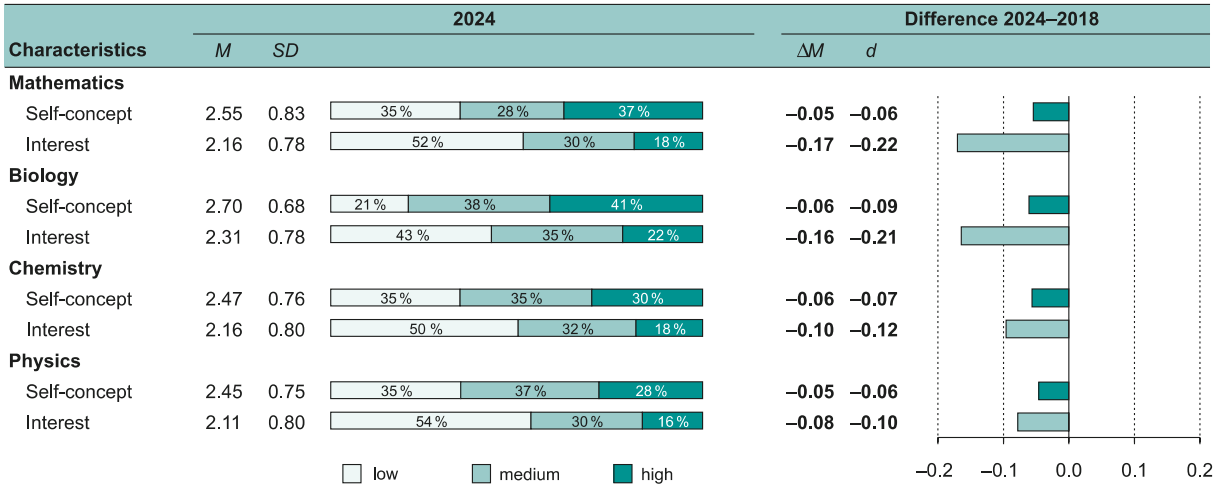
Notes. The indicated values are rounded. As a result, the difference in mean values may deviate slightly from the difference presented (Δ*M*). *M* = mean; *SD* = standard deviation. Δ*M* = difference between students with and students without an immigration background; *SE* = standard error; *d* = effect size Cohen's *d*. In the trend, negative values and left-pointing bars indicate a decrease in students' overall school satisfaction/social integration.
Without immigration background: Both parents were born in Germany.
2nd generation: Both parents are foreign-born, and the student was born in Germany.
1st generation: Both parents and the student are foreign-born (excluding refugee students).
Refugees: Students of the 1st generation with a refugee biography.
Differences printed in bold type are statistically significant ($p < .05$). Solid bars indicate a statistically significant difference ($p < .05$).

8. Motivational characteristics

Subject-specific self-concepts and interests

- In the IQB Trends in Student Achievement 2024, a considerable proportion of students reported that they had a medium or high self-concept[10] and were interested in mathematics and the science subjects. By comparison, some 35 percent of adolescents reported having only a low level of confidence in their own abilities in the subjects mathematics, chemistry and physics; this was the case for 21 percent of students in the subject biology (cf. Fig. 8.1).
- The share of young people exhibiting a weak level of interest in these subjects is alarmingly high. This share stands at 50 percent or more in each of the subjects mathematics, chemistry and physics and at 43 percent in the subject biology.
- On average, boys have a higher assessment of their skills in the subjects mathematics, chemistry and physics than girls do; they report greater interest in the subject matter as well. In biology, on the other hand, girls consider themselves more capable on average and report greater interest than boys. The strength of the observed disparities in self-concepts and interest levels coincides only in part, however, with the identified differences in proficiency (cf. Fig. 8.2).
- The trend analyses for the motivational characteristics show that the mean values for self-concept and interest across all subjects were significantly lower in 2024 than they were in 2018. These unfavorable changes continue the downward trends already observed between 2012 and 2018.
- Gender-related disparities across both motivational characteristics increased significantly between 2018 and 2024: in mathematics to the detriment of girls, and in biology to the detriment of boys.

Figure 8.1: Mean values and standard deviations for the subject-specific self-concept and interest in the subjects of mathematics, biology, chemistry and physics in 2024 and as a trend

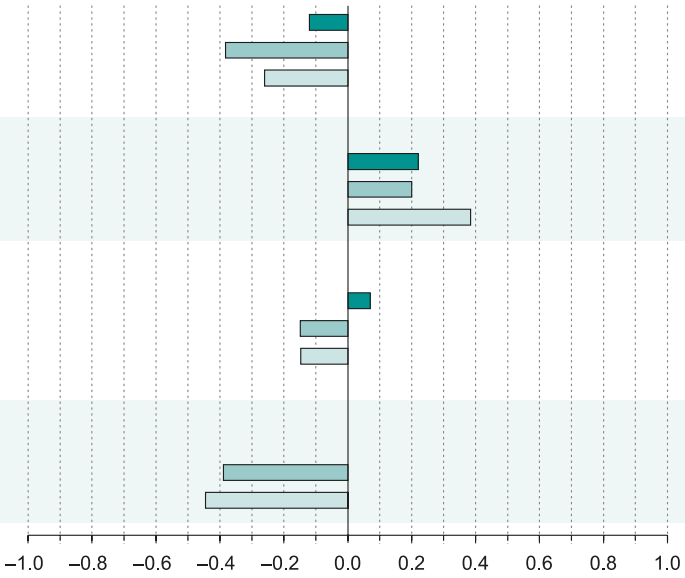


Notes. The stacked bar chart indicates the proportions of students with a low (scale value ≤ 2), medium (scale value > 2 and < 3) and high value (scale value ≥ 3) for self-concept and interest. Because the values provided are rounded, the sum of percentages may differ slightly from 100. As a result, the difference in mean values may also deviate slightly from the difference presented (Δ*M*). *M* = mean; *SD* = standard deviation; Δ*M* = mean difference; *d* = effect size Cohen's *d*.
Differences printed in bold type are statistically significant ($p < .05$). Solid bars indicate a statistically significant difference ($p < .05$).

10 The subject-specific self-concept represents a self-assessment of the students' own abilities in a specific school subject.

Figure 8.2: Differences between girls and boys in proficiencies achieved, in subject-specific self-concept and interest in the subjects of mathematics, biology, chemistry and physics

Characteristics	*d*
Mathematics	
Global scale	**–0.12**
Self-concept	**–0.38**
Interest	**–0.26**
Biology	
Subject knowledge	**0.22**
Self-concept	**0.20**
Interest	**0.38**
Chemistry	
Subject knowledge	**0.07**
Self-concept	**–0.15**
Interest	**–0.15**
Physics	
Subject knowledge	0.00
Self-concept	**–0.39**
Interest	**–0.44**



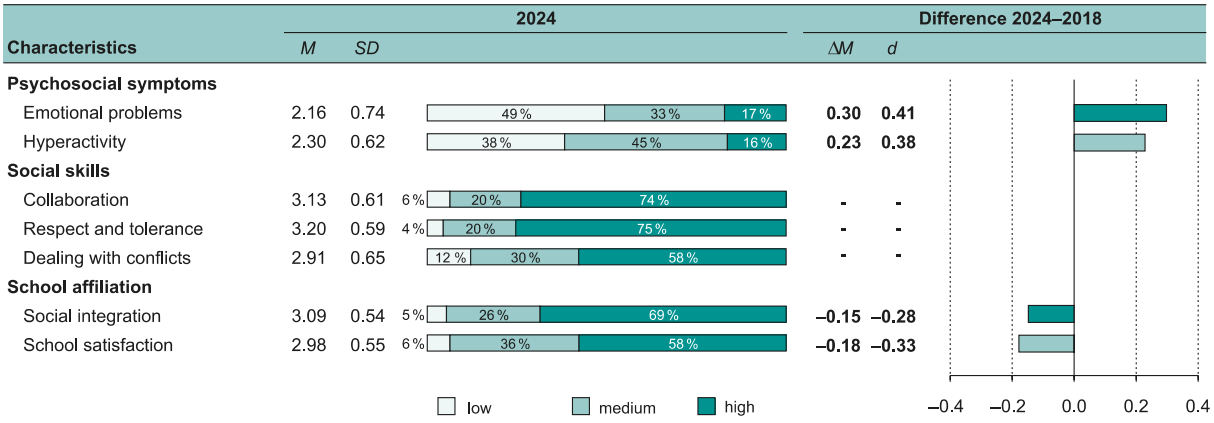
Notes. *d* = effect size Cohen's *d*.
Values printed in bold type are statistically significant ($p < .05$). Solid bars indicate a statistically significant difference ($p < .05$).

9. Interdisciplinary socio-emotional characteristics

Psychosocial symptoms, social skills and school affiliation

- In the IQB Trends in Student Achievement 2024, a considerable proportion of ninth-graders reported that they were scarcely[11] affected by psychosocial symptoms, had high social[12] skills and felt a strong sense of school affiliation.[13]
- Roughly one in six students, however, reported being affected to a greater extent by emotional problems or having frequently felt inattentive and subject to distraction over the course of the previous month. Around one in eight students reports that they are not good at dealing with conflicts (cf. Fig. 9.1).
- Girls report having more emotional problems, feeling less socially integrated in their class and sensing less satisfaction with their school than boys, but they also rate their social skills higher than boys.
- The trend analyses point to unfavorable developments: Psychosocial symptoms increased among adolescents between 2018 and 2024, and their sense of school affiliation decreased. These unfavorable developments affect girls in particular.

Figure 9.1: Means and standard deviations for psychosocial symptoms, social skills and school affiliation in 2024 and as a trend



Notes. The stacked bar chart indicates the proportions of students with a low (scale value ≤ 2), medium (scale value > 2 and < 3) and high value (scale value ≥ 3) in psychosocial symptoms, social skills and school affiliation. Because the values provided are rounded, the sum of percentages may differ slightly from 100. As a result, the difference in mean values may also deviate slightly from the difference presented (Δ*M*). Because social skills were first surveyed in the IQB Trends in Student Achievement 2024, no trends can be reported for these characteristics. *M* = mean; *SD* = standard deviation; Δ*M* = mean difference; *d* = effect size Cohen's *d*.
Differences printed in bold type are statistically significant ($p < .05$). Solid bars indicate a statistically significant difference ($p < .05$).

11 "Psychosocial symptoms" as used here denotes personal challenges in dealing with worries and fears as well as in managing attentiveness.
12 "Social skills" relate to interacting with other people (e.g. collaborating and dealing with conflicts).
13 "School affiliation" refers to a student's relationship with the school and with the school community (e.g. social integration and school satisfaction).

10. Characteristics of instructional quality in mathematics

- Classical forms of learning (classroom instruction, quiet work and small group work) continue to dominate mathematics instruction in 2024; cooperative and differentiating formats (e.g. independent work, peer tutoring) are used much less frequently. Quite regular use is made of methods of internal differentiation (e.g. performance-adaptive tasks).
- Teachers in college-preparatory secondary schools [Gymnasien] offer individualized, cooperative and differentiated instruction with somewhat lower frequency than teachers in other types of schools.
- Only intermittent changes can be seen between 2018 and 2024; these changes are somewhat more pronounced in college-preparatory secondary schools and suggest a slight increase in the use of individualizing and cooperative forms of learning.
- Overall, the ninth-graders rate the in-depth characteristics (e.g. classroom management, constructive support and cognitive activation) that are decisive for high-quality instruction as moderately positive in 2024, with the positive error culture being perceived particularly positively in comparison. This pattern has hardly changed since 2018.
- As anticipated, the surface features of teaching structure are not significantly related to the proficiencies achieved or to subject-specific motivational-emotional characteristics (self-concept, interest, fear) in the subject mathematics.
- Where in-depth characteristics are concerned, the kinds of relationships one would expect to encounter can be seen particularly at the individual level. On average, the students who report a more supportive experience of their instruction in mathematics than their classmates have higher levels of proficiency in mathematics, a higher subject-specific self-concept and interest as well as lower math anxiety. A learning environment that is experienced as low in disturbances is also positively associated with the relevant motivational-emotional characteristics, and a level of cognitive activation that is perceived as higher is associated with a higher level of proficiency.

11. Digital media and applications in mathematics and science instruction

- Most of the mathematics and physics instructors who took part in the IQB Trends in Student Achievement 2024 confidently integrate digital media into their teaching in ways that enrich the content and benefit pedagogical-didactic quality, and they consider the use of digital media in specialized instruction to be important. Around half of the teachers report that the effort that this entails is low. However, nearly 20 percent of teachers associate a high level of effort with the use of digital media in the classroom.
- Nevertheless, digital media were only integrated into mathematics and physics lessons to a limited extent in 2024. Subject-specific software, digital learning offerings and digital sources of information are used most likely. Computers, laptops and tablets are mainly used in the classroom to consolidate and practice content or skills.
- Ninth-graders assign a moderate rating to the quality of mathematics and physics instruction using digital media; their assessment of the support they receive from their teachers in the use of digital media also falls in the medium range.
- As expected, the motivational orientations of instructors as concerns the use of digital media in the classroom and the frequency of use (surface feature) do not directly relate to learning-related student characteristics (self-efficacy in dealing with digital media, subject-specific interest and subject-specific boredom, proficiencies in the subject).

- Students' assessments of the quality characteristics of instruction with digital media (in-depth characteristics), on the other hand, consistently correlate with motivational student characteristics but only sporadically with subject proficiencies. The findings buttress the assumption that digital media can develop their motivating potential only when integrated into instruction in a didactically meaningful way and embedded in a supportive atmosphere of instruction.

12. Mathematics and science teachers: Aspects of their training and assessments of their work

- A substantial share of instructors of mathematics, biology, chemistry or physics in the classes participating in the IQB Trends in Student Achievement 2024 do not have a teaching qualification in the respective subject (around 7-9% in college-preparatory secondary schools [Gymnasien], around 14-21% in other school types).
- There is also increasing employment of teachers who have not completed an undergraduate degree in teaching and instead switched to the teaching profession.
- Classes taught by non-specialist teachers and by those who switched to the profession tend to achieve lower proficiencies on average. This largely owes to the fact that non-specialist teachers and career changers are used more often in non-college-preparatory secondary school types and in classes with a less favorable composition relative to the students' individual learning conditions.
- Largely regardless of their qualifications, the instructors surveyed in the IQB Trends in Student Achievement 2024 have a positive attitude toward their work as instructors. Overall, they express a high level of satisfaction with their career choice and great enthusiasm for teaching.

13. Conclusions

The results of the IQB Trends in Student Achievement 2024 for mathematics and the science subjects at secondary level I are not very encouraging. In all four of the subjects examined, the normative standards are achieved less frequently and students fall short of the minimum standards more often than in 2012 and 2018. Hence, across the overall population of ninth-graders, the share of adolescents falling short of the minimum standard for the first school leaving certificate (ESA) in mathematics increased by just over 3 percentage points in Germany between 2018 and 2024, and the share of adolescents falling short of the minimum standard for the secondary school leaving certificate (MSA) was nearly 10 percentage points higher. These developments mean that nearly 9 percent of all ninth-graders will fall short of the minimum standard for the ESA in the subject mathematics in 2024, with some 34 percent failing to satisfy the minimum standard for the MSA.

Developments are also unfavorable in the subpopulation of ninth-graders aspiring to reach at least the MSA (MSA population). The share of adolescents falling short of the minimum standard for the MSA has increased here by around 5 to 9 percentage points and in 2024 will total to around 24 percent of adolescents in mathematics, 10 percent in biology, 25 percent in chemistry and 16 percent in physics (all in *subject knowledge*).

The share of ninth-graders falling short of the requirements from the educational standards for the school leaving qualification in the mathematical-scientific subjects has thus risen significantly and in 2024 is far too high in the subjects mathematics and chemistry in particular. These unfavorable developments affect not only lower-performing adolescents but also students aspiring to the MSA or a higher school leaving qualification, including students in college-preparatory secondary schools [Gymnasien]. The level of proficiency achieved has decreased as well, largely irrespective of adolescents' socioeconomic and immigration-related backgrounds.

The downward trends in the proficiency levels attained affect all 16 German states, albeit to varying degrees. The differences between the states in 2024 also remain vast: Significantly higher mean values than composite scores for Germany as a whole are achieved in all four subjects studied in Baden-Württemberg, Bayern and Sachsen, and in all three scientific subjects in Mecklenburg-Vorpommern, Sachsen-Anhalt and Thüringen. Significantly lower mean values across all four subjects, on the other hand, can be found in Bremen, Hessen and Nordrhein-Westfalen, as well as in Saarland.

Negative developments can be seen in the IQB Trends in Student Achievement 2024 not only in terms of subject-based proficiencies, but also in the subject-specific motivational and interdisciplinary socio-emotional characteristics of the students considered. Across all of the mathematical-scientific subjects, adolescents' subject-specific self-concept and interest level decreased from 2018 to 2024, and the share of adolescents reporting weak interest in these subjects in 2024 is very high. Students' sense of school affiliation has also fallen significantly since 2018 but remains quite positive in 2024. The findings for two of the three social skills examined for adolescents are also quite encouraging. A slightly higher proportion of adolescents, however, rate their own skills in dealing with conflicts as low. Of particular concern is the significant upturn in psychosocial symptoms and the relatively large share of ninth-graders in 2024 for whom the indicators examined are highly pronounced. All in all, 17 percent of adolescents report experiencing frequent emotional problems, and 16 percent of adolescents report frequently experiencing various indicators of hyperactivity. Girls are particularly affected by these emotional problems. While just 8 percent of boys report a high level of emotional problems, this is the case for 27 percent of girls.

The after-effects of pandemic-related restrictions on school operations and on social contacts likely play a significant role in negative impacts not only on adolescents' subject-specific proficiencies and motivational characteristics, but also on their interdisciplinary socio-emotional characteristics. Generally speaking, the adolescents who participated in the IQB Trends in Student Achievement 2024 were in the 5th grade when the coronavirus pandemic began; in most of the states, then, they had transferred over to secondary level I a little more than half a year prior to this. The fact that the pandemic tore them from this still rather new routine likely represented a major turning point for many of them.

This could have severely affected their development and continued to have an effect four years later. The negative trend in socio-emotional characteristics could also involve concerns about current crises such as wars, economic insecurity and climate change. Furthermore, it is often assumed that social media use can affect children's and adolescents' mental health.

The changes in the proficiency levels achieved also have something to do with further changes in student-body composition. Socioeconomic heterogeneity has increased, and the share of students who immigrated to Germany themselves (first generation) has further grown. At just under 5 percent, the share of students with a refugee biography was also higher in the IQB Trends in Student Achievement 2024 than in previous studies. The German school system is thus called upon to provide considerable integration services. First and foremost, this applies to linguistic integration, which is key to the academic success of children and adolescents with limited command of the German language. Once again, the findings of the IQB Trends in Student Achievement 2024 emphasize the importance of improvements in the fostering of language development for children and adolescents with limited German skills.

The conclusions drawn from the results of the IQB Trends in Student Achievement 2024 substantially underscore the recommendations of the assessments and opinions of the Standing Scientific Commission (SWK) of the Standing Conference of the Ministers of Education and Cultural Affairs of the States in the Federal Republic of Germany (KMK).[14] This applies, first of all, to early support at the elementary-school level, not only of linguistic but also of mathematical and scientific proficiencies. Another key element is the effort to secure basic proficiencies in primary school, together with the key functional proficiencies in secondary level I, which are important to a successful transition into vocational training. Systematic promotion of subject-specific motivation as well as of socio-emotional characteristics and skills is also important. This area should receive greater attention, not only in primary schools but also in secondary schools, taking empirically proven and practicable promotional approaches into account. Collaboration in multi-professional teams plays a central role here. Finally, improvements in the fostering of language development calls for strategic evolution in diagnostics, interventions in language education and teacher qualification.

Schools alone cannot be expected to single-handedly reverse the negative trends in children's and adolescents' performance-related, motivational and socio-emotional development in Germany, however. This calls for the combined effort of all stakeholders: from families and their environments, daycare centers and schools, the officials in charge of managing and equipping educational institutions, the providers of child and youth welfare and extracurricular education, to education-related associations and the universities and institutions responsible for teacher training in the states. The only way to achieve sustainable learning and development targets for children and adolescents in Germany is through coordinated cooperation among all the stakeholders.

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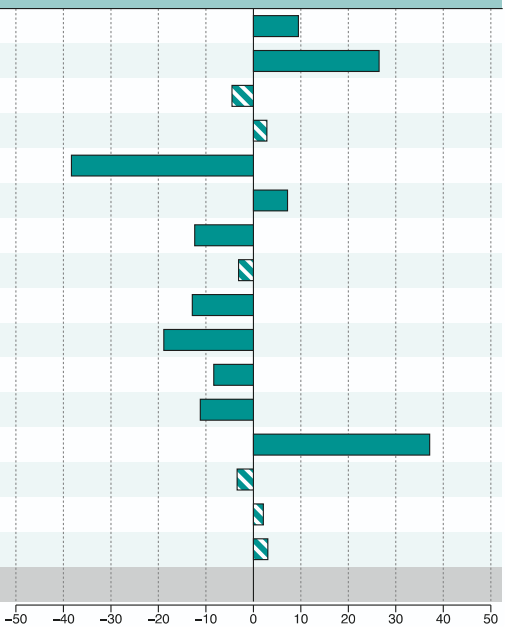
14 In this regard, see in particular:
Kompetenzen für den erfolgreichen Übergang von der Sekundarstufe I in die berufliche Ausbildung sichern. Gutachten der Ständigen Wissenschaftlichen Kommission der Kultusministerkonferenz. http://dx.doi.org/10.25656/01:32815
Sprachliche Bildung für neu zugewanderte Kinder und Jugendliche gestalten – Maßnahmen zur Förderung der Zielsprache Deutsch. Stellungnahme der Ständigen Wissenschaftlichen Kommission der Kultusministerkonferenz. http://dx.doi.org/10.25656/01:32124
Stellungnahme zur Unterstützung geflüchteter ukrainischer Kinder und Jugendlicher – Integration in das Bildungssystem. http://www.swk-bildung.org/veroeffentlichungen
Basale Kompetenzen vermitteln – Bildungschancen sichern. Perspektiven für die Grundschule. Gutachten der Ständigen Wissenschaftlichen Kommission der Kultusministerkonferenz. http://dx.doi.org/10.25656/ 01:25542

Appendix

Mean values and standard deviations of the proficiencies achieved in 2024 by ninth-graders in mathematics (*global scale*)

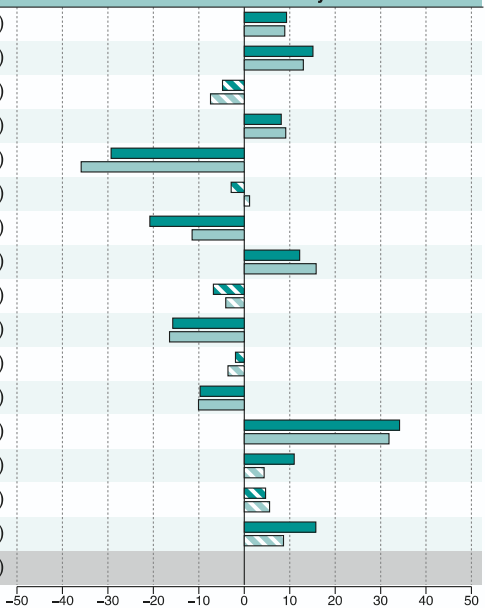
State	*M*	(*SE*)	*SD*	(*SE*)	Deviation from the mean for Germany
Baden-Württemberg	**484**	(2.7)	98	(2.4)	
Bayern	**501**	(2.8)	99	(2.4)	
Berlin	470	(3.9)	**108**	(2.7)	
Brandenburg	477	(3.6)	**91**	(2.4)	
Bremen	**436**	(5.1)	96	(3.6)	
Hamburg	**482**	(2.8)	**108**	(2.4)	
Hessen	**462**	(4.1)	96	(3.4)	
Mecklenburg-Vorpommern	471	(2.6)	**84**	(2.0)	
Niedersachsen	**461**	(3.5)	**85**	(2.4)	
Nordrhein-Westfalen	**455**	(2.9)	93	(2.2)	
Rheinland-Pfalz	**466**	(3.4)	94	(2.7)	
Saarland	**463**	(3.3)	92	(2.7)	
Sachsen	**511**	(3.4)	96	(3.2)	
Sachsen-Anhalt	471	(3.9)	93	(3.3)	
Schleswig-Holstein	476	(2.9)	**88**	(2.2)	
Thüringen	477	(4.6)	97	(3.4)	
Germany	474	(1.2)	97	(1.0)	



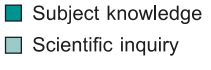
Notes. The indicated values are rounded. *M* = mean; *SE* = standard error; *SD* = standard deviation.
Values printed in bold type differ statistically significantly ($p < .05$) from the value for all ninth-graders in Germany as a whole.
Hatched bars indicate a statistically non-significant difference from the value for all ninth-graders in Germany as a whole.

Mean values and standard deviations of the proficiencies achieved in 2024 by ninth-graders in biology

	Biology subject knowledge				Biology scientific inquiry				
State	*M*	(*SE*)	*SD*	(*SE*)	*M*	(*SE*)	*SD*	(*SE*)	Deviation from the mean for Germany
Baden-Württemberg	**482**	(3.6)	99	(2.6)	**486**	(3.5)	103	(2.2)	
Bayern	**488**	(3.0)	97	(2.4)	**490**	(3.2)	100	(2.7)	
Berlin	468	(3.9)	**104**	(2.3)	469	(4.1)	**112**	(2.5)	
Brandenburg	**481**	(3.7)	93	(2.7)	**486**	(3.2)	**95**	(2.3)	
Bremen	**443**	(3.2)	95	(2.3)	**441**	(4.2)	100	(2.5)	
Hamburg	470	(3.1)	**101**	(2.2)	478	(3.0)	**109**	(2.3)	
Hessen	**452**	(3.5)	99	(2.8)	**465**	(4.7)	103	(3.8)	
Mecklenburg-Vorpommern	**485**	(2.8)	**84**	(1.8)	**492**	(3.0)	**89**	(2.3)	
Niedersachsen	466	(4.2)	92	(2.8)	473	(4.0)	102	(2.5)	
Nordrhein-Westfalen	**457**	(3.0)	**89**	(2.1)	**460**	(3.4)	97	(2.2)	
Rheinland-Pfalz	471	(3.2)	95	(2.5)	473	(3.5)	99	(2.5)	
Saarland	**463**	(3.9)	93	(2.2)	**467**	(4.6)	97	(2.9)	
Sachsen	**507**	(2.2)	**88**	(2.1)	**508**	(2.8)	**93**	(2.6)	
Sachsen-Anhalt	**484**	(3.3)	93	(2.2)	481	(3.7)	**94**	(2.9)	
Schleswig-Holstein	477	(3.0)	91	(2.5)	482	(4.0)	100	(2.9)	
Thüringen	**489**	(3.6)	93	(2.5)	485	(4.3)	97	(3.3)	
Germany	473	(1.2)	95	(0.9)	477	(1.4)	101	(0.9)	

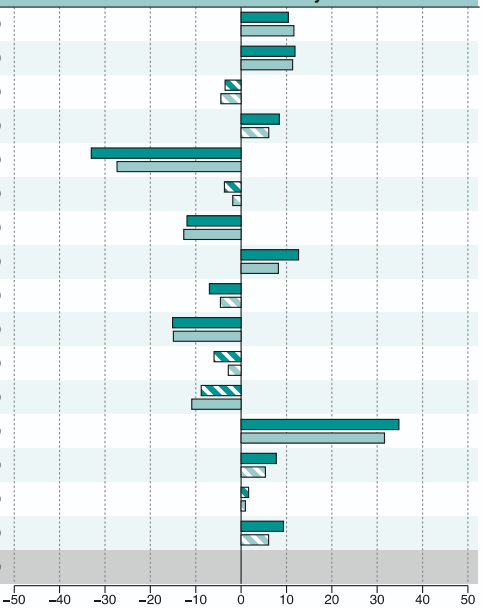


Notes. The indicated values are rounded. *M* = mean; *SE* = standard error; *SD* = standard deviation.
Values printed in bold type differ statistically significantly ($p < .05$) from the value for all ninth-graders in Germany as a whole. Hatched bars indicate a statistically non-significant difference from the value for all ninth-graders in Germany as a whole.



Mean values and standard deviations of the proficiencies achieved in 2024 by ninth-graders in chemistry

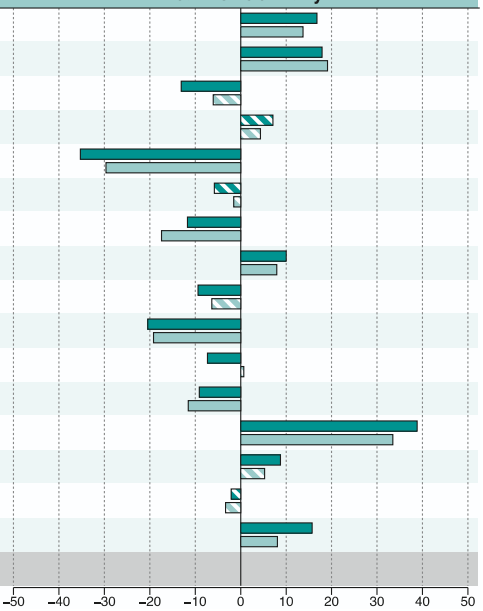
State	Chemistry subject knowledge				Chemistry scientific inquiry			
	M	(*SE*)	*SD*	(*SE*)	*M*	(*SE*)	*SD*	(*SE*)
Baden-Württemberg	**482**	(3.3)	**99**	(2.3)	**485**	(3.1)	**99**	(2.1)
Bayern	**483**	(2.8)	94	(2.4)	**484**	(3.0)	**100**	(2.6)
Berlin	468	(3.7)	**105**	(2.6)	468	(3.6)	**106**	(2.4)
Brandenburg	**480**	(3.3)	**87**	(2.3)	479	(3.0)	**87**	(2.3)
Bremen	**438**	(4.2)	98	(2.8)	**446**	(3.9)	93	(2.9)
Hamburg	468	(2.6)	**100**	(1.9)	471	(2.8)	**105**	(2.2)
Hessen	**460**	(3.4)	90	(2.4)	**460**	(3.8)	91	(2.5)
Mecklenburg-Vorpommern	**484**	(2.6)	**83**	(1,9)	**481**	(2.7)	**84**	(2.1)
Niedersachsen	**464**	(3,2)	**86**	(2.0)	468	(3.5)	**87**	(2.2)
Nordrhein-Westfalen	**456**	(2,8)	**88**	(2,0)	**458**	(3.0)	**86**	(2.3)
Rheinland-Pfalz	466	(3.1)	90	(2.3)	470	(3.2)	91	(2.2)
Saarland	463	(4.3)	92	(2.5)	**462**	(4.4)	93	(2.6)
Sachsen	**506**	(3.0)	95	(2.5)	**505**	(2.8)	93	(2.5)
Sachsen-Anhalt	**479**	(3.3)	90	(2.5)	478	(3.3)	**89**	(2.3)
Schleswig-Holstein	473	(2.7)	**87**	(2.1)	474	(3.1)	91	(2.2)
Thüringen	**481**	(4.1)	97	(3.0)	479	(4.0)	92	(3.0)
Germany	471	(1.2)	93	(0.8)	473	(1.3)	94	(0.9)



Notes. The indicated values are rounded. *M* = mean; *SE* = standard error; *SD* = standard deviation. Values printed in bold type differ statistically significantly ($p < .05$) from the value for all ninth-graders in Germany as a whole. Hatched bars indicate a statistically non-significant difference from the value for all ninth-graders in Germany as a whole.

Mean values and standard deviations of the proficiencies achieved in 2024 by ninth-graders in physics

State	Physics subject knowledge				Physics scientifc inquiry			
	M	(*SE*)	*SD*	(*SE*)	*M*	(*SE*)	*SD*	(*SE*)
Baden-Württemberg	**491**	(3.3)	101	(2.3)	**490**	(3.1)	99	(2.4)
Bayern	**492**	(3.0)	99	(2.7)	**496**	(2.8)	99	(2.2)
Berlin	**461**	(4.4)	**114**	(2.9)	471	(4.2)	**113**	(2.7)
Brandenburg	481	(3.4)	**89**	(2.3)	481	(3.1)	**90**	(2.3)
Bremen	**439**	(4.0)	102	(2.8)	**447**	(3.3)	**90**	(2.2)
Hamburg	468	(3.0)	**105**	(2.1)	475	(2.9)	**104**	(2.3)
Hessen	**462**	(4.1)	96	(2.4)	**459**	(3.9)	97	(2.8)
Mecklenburg-Vorpommern	**484**	(3.0)	**83**	(2.1)	**485**	(2.6)	**84**	(2.1)
Niedersachsen	**465**	(3.5)	**90**	(1.9)	470	(3.7)	**91**	(2.3)
Nordrhein-Westfalen	**454**	(2.9)	**90**	(2.1)	**457**	(2.9)	**91**	(2.2)
Rheinland-Pfalz	**467**	(3.4)	96	(2.0)	477	(3.1)	95	(2.3)
Saarland	**465**	(4.1)	96	(2.6)	**465**	(4.1)	98	(2.7)
Sachsen	**513**	(3.1)	97	(2.4)	**510**	(2.5)	**90**	(2.2)
Sachsen-Anhalt	**483**	(3.6)	97	(2.6)	482	(3.3)	94	(2.4)
Schleswig-Holstein	472	(3.1)	93	(2.3)	473	(3.3)	93	(2.3)
Thüringen	**490**	(3.6)	95	(2.6)	**485**	(3.9)	94	(2.7)
Germany	474	(1.2)	97	(0.9)	477	(1.2)	97	(0.8)



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Further information on the IQB Trends in Student Achievement 2024:

Petra Stanat, Stefan Schipolowski,
Sarah Gentrup, Karoline A. Sachse,
Sebastian Weirich, Sofie Henschel (Hrsg.)

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