



PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA) RESULTS FROM PISA 2018

21st-Century Readers: Developing literacy skills in a digital world

Germany

Summary of Key Aspects

- Students' reading performance in Germany reveals systematic disparities between boys and girls, and between socio-economically advantaged and disadvantaged students.
- As observed in many other countries and economies, using effective reading strategies for assessing the credibility of sources is a key factor for a high level of reading literacy in 15-year-old students in Germany.
- The gender gap in reading performance is mirrored in the gender gaps in students' knowledge of three reading strategies (i.e. the indices of student knowledge of reading strategies for understanding and remembering, for writing a summary, and for assessing the credibility of sources).
- The relationship between reading performance and time spent using digital devices for schoolwork was negative in 35 countries and economies, especially in Germany.
- Students' enjoyment of reading significantly decreased between 2009 and 2018 in Germany. Only two other countries, Finland and Norway, show a similar magnitude in decline. In Germany, the gender and socio-economic gaps in enjoyment of reading is one of the largest among all participants in PISA 2018.

Introduction

As an international comparative large-scale assessment in education, PISA has been providing a solid database to serve as an empirical point of reference for educational policy making for over two decades. PISA allows the performance of 15-year-old students in the domains of reading, mathematics and science toward the end of compulsory schooling to be described, analysed and compared to other educational systems. In that sense, PISA allows statements on how well 15-year-old students are prepared for participation in societies. Every three years, a PISA assessment has been conducted, alternating its main focus among the three domains. PISA 2018 marks the kick-off to the study's third 9-year cycle, reading being the major domain for the third time after PISA 2000 and 2009. The PISA 2018 assessment framework for reading was revised to capture reading in printed and digital media by further elaborating emerging aspects related to reading in a digital world.

Findings for Germany from the PISA report "21st-Century Readers" (OECD, 2021^[1]) reveal various aspects that merit a closer look in developing useful educational policy measures that broaden students' reading literacy. These aspects include: (1) students' opportunity to learn digital skills and the issues of where and how students develop reading literacy; (2) reading strategies as a key to success; (3) relevant aspects of print reading in a digital world; (4) disparities in reading performance related to gender, socio-economic status and school type.

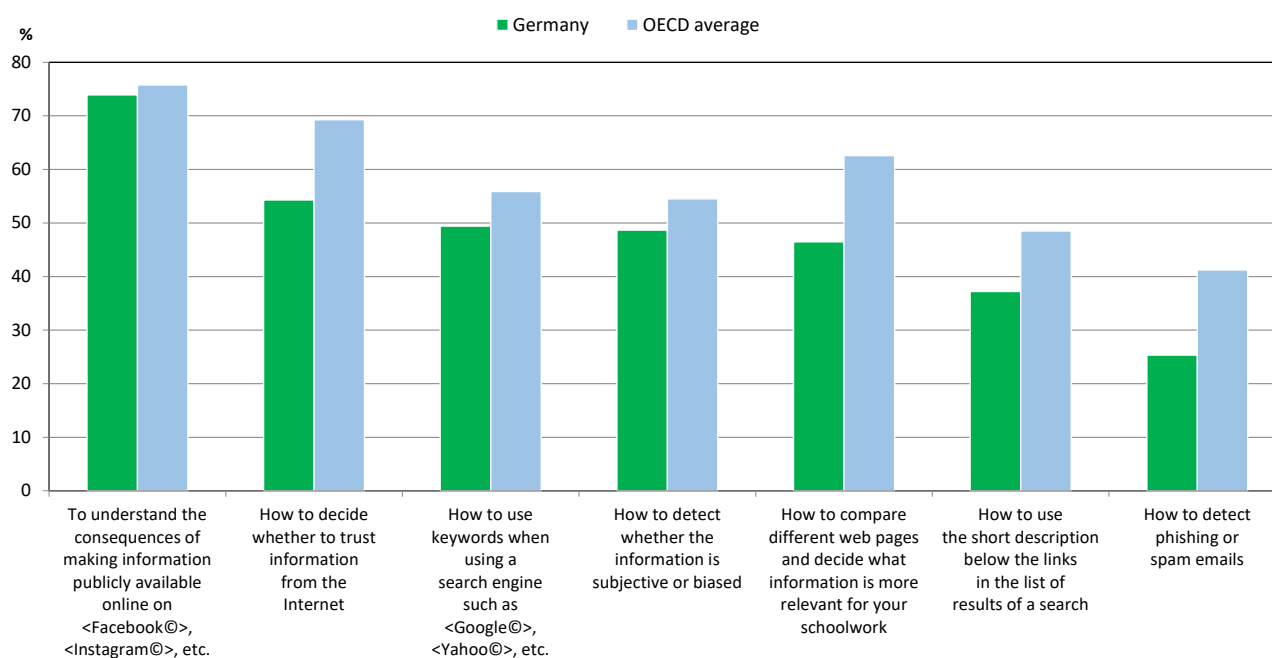
Reading is one of the universal domains in literacy assessments worldwide. Unlike mathematics and science for which learning is mainly located in schools (Baumert et al., 2004^[2]), reading is practiced in many occasions and various settings, including outside school. The question as to where, how and in which contexts German students learn, practice and elaborate their reading literacy is thus not a simple one to answer. First, learning to read is not limited to lessons in the language of instruction (i.e., in Germany: German), but involves many other school subjects where texts and other types of organised information are treated. Second, in a federal educational system like Germany, there are systematic differences due to the 16 different educational systems that exist within one national PISA sample. This also adds to the variance in student achievement; in other words, there are numerous sources of variance at the levels of country, federal state, school and teacher when it comes to explaining differences in student achievement. Third, digital reading differs from the mostly linear reading of print books (Hahnel et al., 2016^[3]) as it requires connecting different sources through hypertexts and, of course, ICT-related skills. Fourth, reading is practiced and improved in various everyday situations outside the school context and hence very individually. While the PISA assessment cannot determine *where* students acquire and develop their competences, it provides a sound database for deriving conclusions on how key competences like reading are shaped.

Internet use among 15-year-olds in OECD countries has risen from 21 hours a week in PISA 2012 to 35 hours per week in PISA 2018 (OECD, 2021^[1]). Compared to PISA 2012, this corresponds to an increase of 66% in only 6 years and is almost as much time as an average adult workweek in OECD countries.

The PISA 2018 framework for reading defines reading literacy as a complex and modern set of competencies. More than ever, judging the credibility of sources – especially online sources – is key to the successful mastery of information (Bråten, Stadler and Salmerón, 2018^[4]) (OECD, 2019^[5]). Recent research shows that students' basic computer skills predict their skills in evaluating information retrieved online (Hahnel et al., 2016^[3]). They also predict students' selection of relevant hypertext pages in online environments. But digital reading literacy goes beyond basic computer skills. Students in PISA 2018 reported on whether they were taught how to decide whether or not to trust information from the Internet and how to detect whether such information is subjective or biased (OECD, 2021^[1]).

In Germany, as in many other countries, only about half (49%) of students reported being trained at school on how to recognise whether information is biased or not (OECD average: 54%, Figure 1). While training in digital skills is far from universal at school according to students' reports, there is also a clear relationship with students' socio-economic background when it comes to opportunities to learn relevant reading skills for digital environments. On average across OECD countries, students from disadvantaged¹ backgrounds reported less training on how to detect biased information on the Internet at school than students from advantaged backgrounds (percentage difference: 8 points). This difference is even larger in Germany as well as in Belgium, Brunei Darussalam, Denmark, Luxembourg, Sweden, the United Kingdom and the United States (14 points or higher).

¹ The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS). A socio-economically disadvantaged (advantaged) school is a school in the bottom (top) quarter of the ESCS in the relevant country/economy.

Figure 1. Opportunity to learn digital literacy skills at school**Percentage of students who reported they were taught the following activities at school**

Activities are ranked in descending order of the percentage of students in Germany.

Source: OECD, PISA 2018 Database, Table B.2.6.

In Germany, the PISA reading released item of distinguishing fact from opinion was estimated to be 45% correct (OECD average: 47%²). Detecting biased information is a skill that can be taught and learned at school but students' time spent on the Internet often happens outside of school (OECD, 2021^[1]). Taking this into account, the question arises whether students in Germany are particularly well prepared for dealing with online risks. Only about half of 15-year-old students in Germany remembered being trained at school for dealing with information retrieved online. Existing in-depth studies on opportunities to learn outside school reveal that when using digital media outside school, adolescents tend to show rather unfavourable motivational profiles: Using data from the International Computer and Information Literacy Study (ICILS) on students in the 8th grade, (Senkbeil, 2017^[6]) shows that they appreciate entertainment and socially interactive applications but not educational or informative ones. Furthermore, the participating eight-graders lacked digital skills needed for advancing in a digital learning environment (Senkbeil, 2017^[6]). This finding was confirmed to hold especially for students in Germany compared to other countries in ICILS 2013 (Eickelmann, Bos and Vennemann, 2015^[7]). Hence, adolescents need instructional support for developing skills and competencies to master digital media (Bulgar, Mayer and Metzger, 2014^[8]). The Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (Kultusministerkonferenz, KMK) has started to tackle this challenge in their strategy of 2016 by initiating teaching and learning with digital media at school (KMK, 2016^[9]).

Does the use of digital devices in and for school go along with higher reading proficiency? In PISA 2018, the relationship between reading performance and time spent using digital devices for schoolwork was negative in 35 countries and economies after accounting for students and schools' socio-economic status. In Germany, this negative association was the strongest across all participants. The change in reading performance associated with a one-hour increase in using digital devices for school in total time a week is -27 points (OECD average: -7 points) after accounting for students' and schools' socio-economic status.³

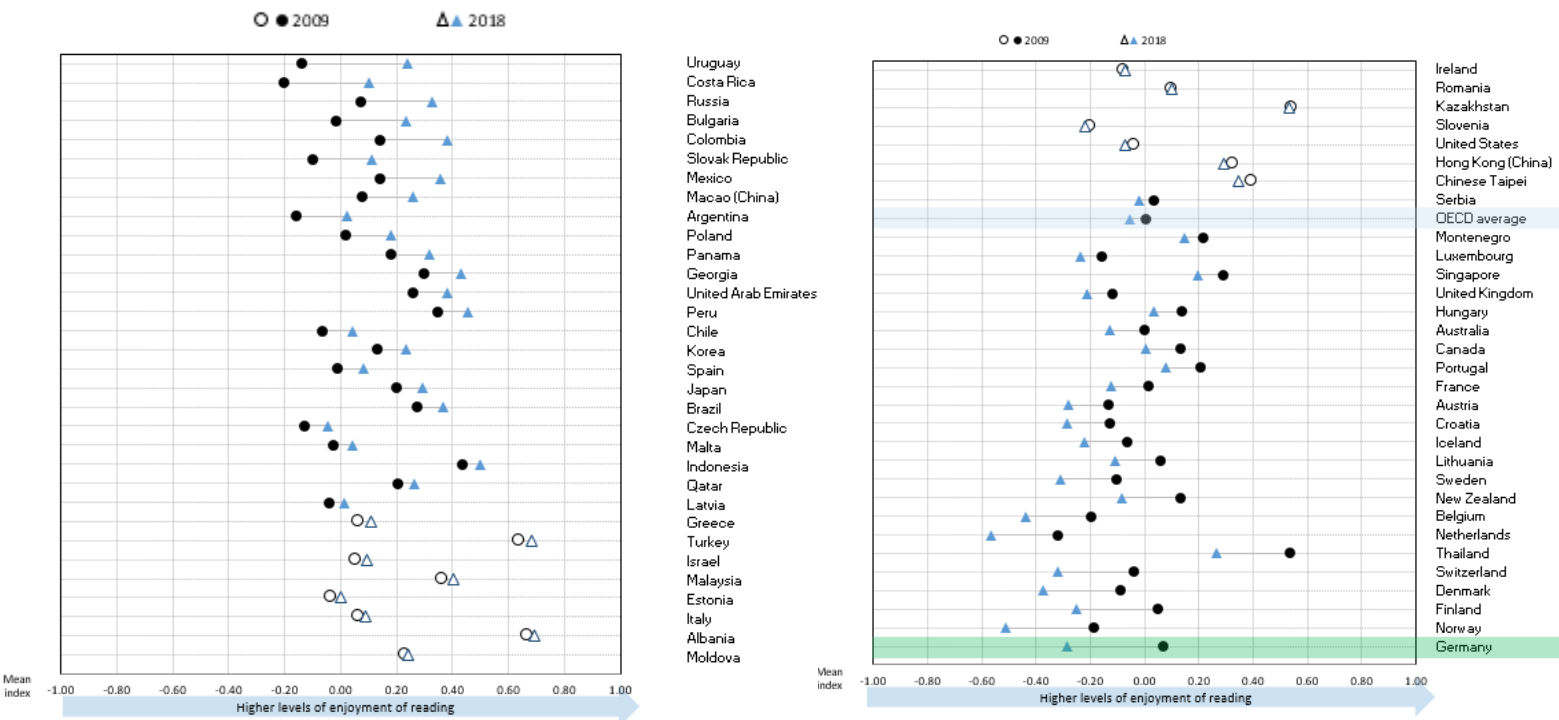
² Rapa Nui Question 3 is a partial credit item where non-credit is scored 0, partial credit is scored 0.5, and full credit is scored 1. Therefore, the estimated percentage correct for full credit in this item is lower than 47%, on average across OECD countries. This item was estimated to be 39% correct, on average across all PISA 2018 participating countries and economies. Rapa Nui Question 3 is a Level 5 item. This means that students need to have a proficiency level 5 to have a 62% probability of getting full credit in this item (see Figure I.2.1, (OECD, 2019^[31])).

³ The change in reading performance associated with a one-hour increase in total time a week using digital devices for school is also -27 points among students attending general programmes. It is -9 points, which is not statistically significant, among students attending vocational programmes.

According to PISA 2018, three out of four 15-year-old students reported that they used digital devices for learning on average across OECD countries. Only one out of two students reported the same in Germany (OECD, 2021_[11]). The International Computer and Information Literacy Study (ICILS) 2018 provides similar results for students in grade 8, at age 13 or 14 (Eickelmann et al., 2019_[10]). The ICILS 2018 results show that schools in Germany make little use of digital devices in school, especially compared to other countries. This relatively rare use is found across school types and across subjects. Two-thirds of eighth-graders in Germany reported never having used digital media in class (Schaumburg et al., 2019_[11]). Despite the little use of digital media in school, 15-year-old students in Germany scored particularly high in the index for assessing the credibility of sources on a phishing email task (see Box 1, Figure 3). Furthermore, the ICILS 2018 results showed that Germany is one of only two countries (besides Portugal) in which the frequency of using digital devices in school for school-related purposes is negatively related to computer- and information-based competencies (Schaumburg et al., 2019_[11]).

A key question for educational research would be to inquire into why the correlation of frequent use of digital media in school for school purposes and students' ICT competencies or student reading performance is negative. This negative relationship has already been found in earlier rounds of PISA for digital reading (e.g. (Naumann and Sälzer, 2017_[12]) (OECD, 2019_[13]) (OECD, 2016_[14])) and points to the fact that when students use ICT in their homes or at school, it is not positively associated with their digital reading proficiency. PISA results are correlational, so it is impossible to determine a causal direction in the identified relationships, e. g. whether students' use of ICT results in lower performance or whether low-performing students tend to use ICT more frequently. One plausible hypothesis about this consistent finding is suggested by some recent meta-analyses: Students' use of digital media *per se* does not support learning but teachers' targeted and purposeful use of digital media and devices for certain processes of learning has a huge potential to boost students' competence development, among others, in reading (Delgado et al., 2018_[15]) (Furenes, Kucirkova and Bus, 2021_[16]). Factors to take into account here in future studies are a differentiated analysis of the frequency and purpose of using digital media in, for and outside school as well as in teaching practices in school subjects with a meaningful proportion of reading requirements. Studies like the TALIS-Video-Study (Teaching and Learning International Survey) are promising examples that can be expanded to the domain of reading.

Figure 2. Change between 2009 and 2018 in the enjoyment of reading



Notes: Statistically significant differences between PISA 2018 and PISA 2009 are marked in a darker tone. Costa Rica, Georgia, Malta and Moldova conducted the PISA 2009 assessment in 2010 as part of PISA 2009+. Countries and economies are ranked in ascending order of the change between 2009 and 2018 (PISA 2018 - PISA 2009) in the index of enjoyment of reading. Source: OECD, PISA 2018 Database, Table B.4.4a.

The question of how students acquire their reading proficiency outside school is especially pertinent with regard to the PISA 2018 finding that students' enjoyment of reading has significantly declined. While students' enjoyment of reading decreased in around a half of OECD countries, the most pronounced decline was observed in Germany, Finland and Norway (Figure 2). For example, 11 percentage points more students in Germany reported in PISA 2018 than in PISA 2009 that they read only if they have to (8 percentage points on average across OECD countries), referring to both digital and print reading material. Furthermore, this trend can be found both in boys and girls and across school types in Germany. Students who read for pleasure tend to score higher in reading performance in all the countries and economies that participated in PISA 2018, including Germany. For students to fulfil their potential, it is important to understand why students' enjoyment of reading has decreased over time. Further research on this is necessary.

Reading strategies: A key to success

The 21st-Century Readers report shows how important and effective different metacognitive strategies are for students' reading performance (see Box 1) across all participating countries and economies. Understanding and memorising a text, summarising information, and assessing the credibility of sources of information are key competences contributing to students' overall reading performance. Students with a sound knowledge of effective reading strategies are more likely to have a strictly focused navigation and to actively explore single- and multiple-source items in the PISA test and show a higher proficiency in reading (OECD, 2021_[11]).

Students in Germany as well as Denmark, Ireland, Japan, the Netherlands, and the United Kingdom scored the highest in the index of reading strategies for assessing the credibility of sources (higher than 0.20 points, Figure 3). The results for Germany also indicate that there is a considerable gap between advantaged and disadvantaged students in mastering effective reading strategies. Germany showed the fourth largest socio-economic gap across all participating countries and economies in PISA 2018 in this index, after Switzerland, Luxembourg, and the United States. Knowledge of effective reading strategies seems to play a crucial role with regard to aspects of equity. When comparing students with similar socio-economic status, those who have better knowledge of effective reading strategies are more likely to be proficient readers (OECD, 2021_[11]); this is valid both for boys and girls. In that sense, being equipped with effective reading strategies is an effective mediator in the association between student backgrounds (e.g. socio-economic status and gender) and reading performance.

All three reading strategies captured in PISA 2018 are positively associated with students' reading proficiency; among those, assessing the credibility of sources is the most strongly associated with reading performance after accounting for background variables like gender and socio-economic status (OECD, 2021_[11]). Since students' socio-economic status cannot be changed by policy measures and performance differences by socio-economic background persist throughout children's school careers (Mergele, Raith and Zierow, 2020_[17]), teaching effective metacognitive reading strategies (Autin and Croizet, 2012_[18]) is one way of mitigating socio-economic differences.

As recent research on the role of reading strategies and basic computer skills shows, students' familiarity with handling computers helped them select relevant websites in digital texts (Hahnel et al., 2016_[3]). Students who know how information is organised in a digital environment are more likely to retrieve websites containing relevant information. Though not a direct effect of being familiar with computers and digital environments, these capabilities are the precondition for a proficient use of digital media, which, in turn, affects students' reading performance.

Box 1. PISA 2018 scenario-based assessment of knowledge of reading strategies

The PISA 2018 questionnaires included three scenarios assessing students' knowledge of strategies for "Understanding and remembering" (undrem, ST164), "Summarising" (metasum, ST165) and "Assessing credibility" (metaspam, ST166). Metaspam was newly developed for PISA 2018. Each scenario consists of (a) a stem which is a reading task and (b) a set of strategies. Students were asked to rate how useful the strategies were for solving the reading task. All strategies were also rated by reading experts via multiple pairwise comparisons. This rating resulted in a hierarchy of all strategies for each task based on all the pairs agreed upon by at least 80% of the experts. For the new metaspam scenario (based on question ST166), for example, the experts' ratings resulted in the following order: Q02HA, Q04HA, Q05HA > Q01HA, Q03HA. The final scores assigned to each student for each task ranges from 0 to 1 and can be interpreted as the proportion of the total number of expert pairwise relations that are consistent with the student ordering. The higher the score, the more a student chose an expert-validated strategy over a less useful one. Finally, all three indices were standardised to have an OECD mean of 0 and a standard deviation of 1. Nonetheless, one should be cautious when comparing countries' and economies' means in these indices as cross-cultural comparability is not always guaranteed.

Reading Task: *You have received a message in your inbox from a well-known mobile phone operator telling you that you are one of the winners of a smartphone. The sender asks you to click on the link to fill out a form with your data so they can send you the smartphone.*

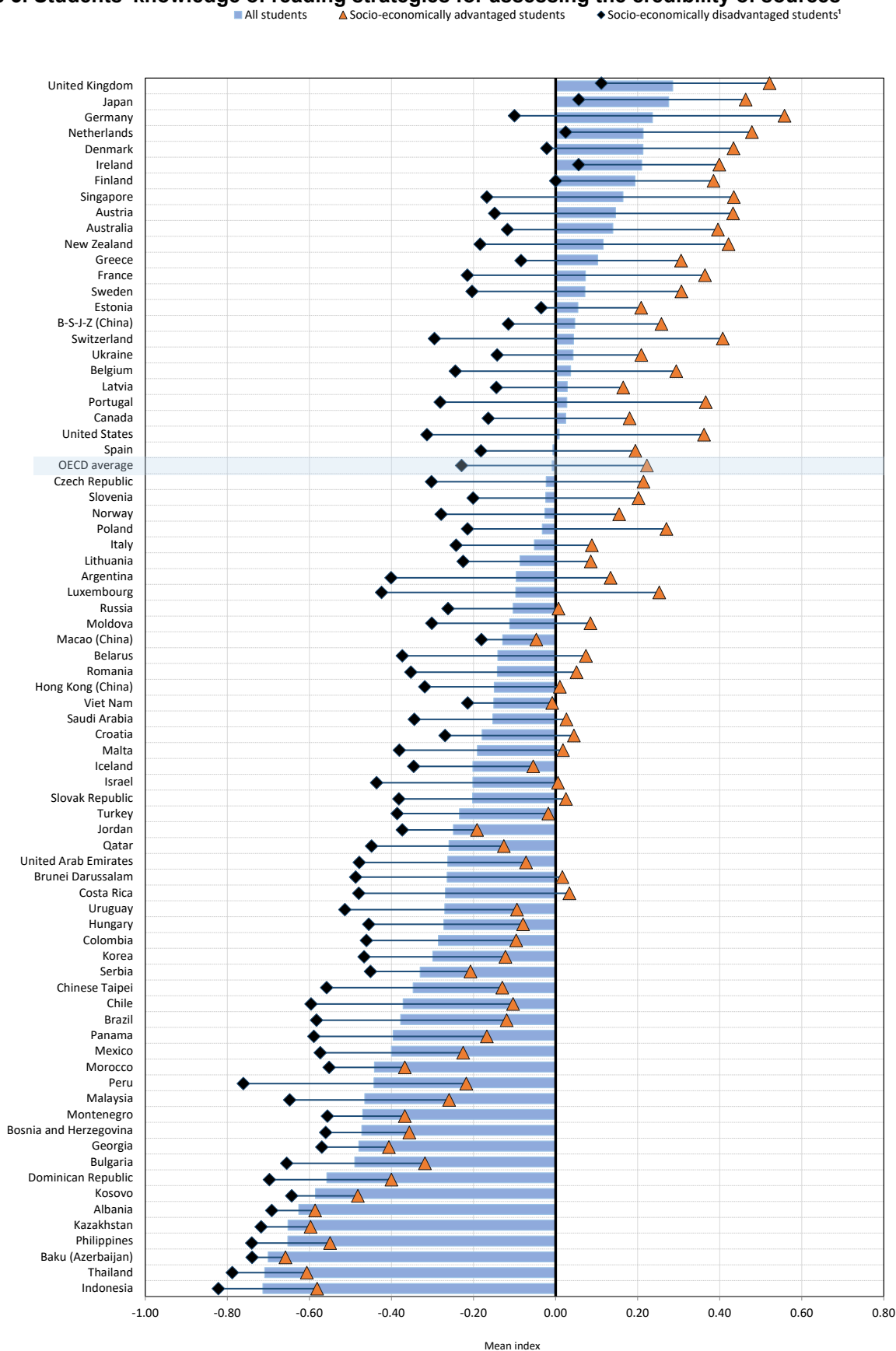
In your opinion, how appropriate are the following strategies in reaction to this email?

ST166

(Please select one response in each row.)

		<i>Not appropriate at all</i>			<i>Very appropriate</i>		
		<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	<i>(6)</i>
ST166Q01HA	Answer the email and ask for more information about the smartphone	<input type="checkbox"/> ₀₁	<input type="checkbox"/> ₀₂	<input type="checkbox"/> ₀₃	<input type="checkbox"/> ₀₄	<input type="checkbox"/> ₀₅	<input type="checkbox"/> ₀₆
ST166Q02HA	Check the sender's email address	<input type="checkbox"/> ₀₁	<input type="checkbox"/> ₀₂	<input type="checkbox"/> ₀₃	<input type="checkbox"/> ₀₄	<input type="checkbox"/> ₀₅	<input type="checkbox"/> ₀₆
ST166Q03HA	Click on the link to fill out the form as soon as possible	<input type="checkbox"/> ₀₁	<input type="checkbox"/> ₀₂	<input type="checkbox"/> ₀₃	<input type="checkbox"/> ₀₄	<input type="checkbox"/> ₀₅	<input type="checkbox"/> ₀₆
ST166Q04HA	Delete the email without clicking on the link	<input type="checkbox"/> ₀₁	<input type="checkbox"/> ₀₂	<input type="checkbox"/> ₀₃	<input type="checkbox"/> ₀₄	<input type="checkbox"/> ₀₅	<input type="checkbox"/> ₀₆
ST166Q05HA	Check the website of the mobile phone operator to see whether the smartphone offer is mentioned	<input type="checkbox"/> ₀₁	<input type="checkbox"/> ₀₂	<input type="checkbox"/> ₀₃	<input type="checkbox"/> ₀₄	<input type="checkbox"/> ₀₅	<input type="checkbox"/> ₀₆

Figure 3. Students' knowledge of reading strategies for assessing the credibility of sources



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS). A socio-economically disadvantaged (advantaged) student is a student in the bottom (top) quarter of the ESCS in the relevant country/economy.

Note: All differences between socio-economically advantaged and disadvantaged students are statistically significant.

Countries and economies are ranked in descending order of the mean index of all students' knowledge of reading strategies for assessing the credibility of sources.

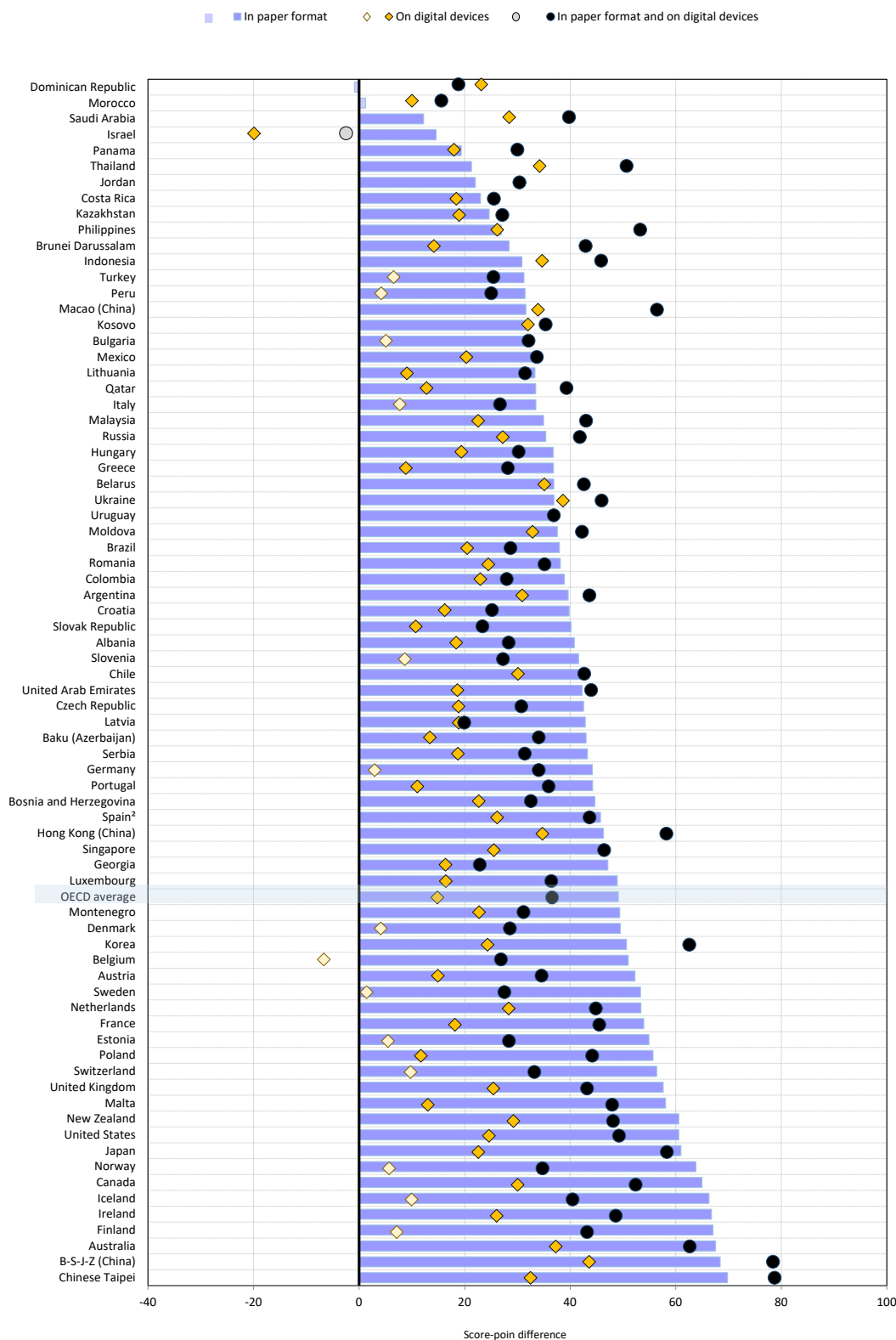
Source: OECD, PISA 2018 Database, Tables B.5.11 and B.5.12c.

The PISA 21-st Century Readers report suggests that digital devices are increasingly displacing print media, particularly in activities most closely tied to reading for information (e.g. newspapers, magazines). Yet, print book readers still read diverse kinds of reading materials (e.g. books, magazines, newspapers, websites, etc.) for pleasure more hours a week than digital book readers. The biggest book readers balance their reading time between paper and digital. One interesting finding for Germany as well as for many other countries and economies participating in PISA 2018 is that compared to students who rarely or never read books, print-book readers (i.e. students who read books more often in paper format than on digital devices) scored 44 points more in reading performance assessed in a computer-based test environment (Figure 4). Students who read books equally often in paper format and on digital devices scored 34 points more in reading, even after accounting for the students' and school's socio-economic profile and gender. Most strikingly, no differences in reading scores were observed in Germany between digital-book readers (i.e. students who read books more often on digital devices than in paper format) and students who rarely or never read books—as opposed to the OECD-average, where this difference is 15 score-points.

These PISA results for students in Germany suggest that reading practice is associated with reading performance, but only under certain conditions (OECD, 2021_[11]). Why does reading digital books exclusively not correspond to higher reading scores when compared to non-book readers? This requires further insights into students' reading preferences for print or digital media as well as the kind of texts they read. According to the ICILS 2018, around 2 in 5 eighth-graders in Germany reported using digital media at least in some German lessons (the international average was 2 in 3; (Schaumburg et al., 2019_[11]). According to school principals in ICILS 2018, Germany was among the lowest of all participating countries in prioritising digital media for teaching in school (Eickelmann et al., 2019_[19]). A meta-analysis by Furenes, Kucirkova and Bus (2021) points out that in school settings, the use of print books is more positively associated with reading performance than digital books, while studies carried out at home or in labs show no medium difference in performance. Digital books in the school context do not automatically carry a value-added that transfers to higher reading literacy. Especially for students from disadvantaged socio-economic backgrounds, the use of print books outperforms the use of digital books in all cases where the digital books are not well-designed multimedia books (Furenes, Kucirkova and Bus, 2021_[16]). Delgado et al.'s (2018) meta-analysis distilled a differential effect for fiction and non-fiction (expository texts) in print and digital media: They found a screen inferiority for non-fiction, but not for fiction and hence suggest an interaction between the screen inferiority effect and the reading genre. To conclude with regard to educational policy making and curriculum development, this detailed evidence may provide a fruitful basis for systematically innovating teaching in German schools in cases where the specific value-added of digital media is still not fully used or their potential not adequately examined. The question of where and on which occasions students develop their reading literacy in a digital world is worth a closer look, especially with regard to the evidence described above on the negative relationship of using digital devices in and for school with ICT competences.

Figure 4. Reading performance, by the format of reading and student characteristics

Score-point change in reading performance, after accounting for students' and school's socio-economic profile¹, and gender



1. The socio-economic status is measured by the PISA index of economic, social and cultural status (ESCS).

2. For the comparability of Spain's data see PISA 2018 Results (Volume I): What Students Know and Can Do, Annex A9.

Note: Statistically significant score-point change are marked in a darker tone.

Countries and economies are ranked in descending order of the score-point change in reading performance, for students who read books more often in paper format.

Source: OECD, PISA 2018 Database, Table B.4.16.

Gender gap

Reading literacy is characterised by remarkably consistent gender differences of substantial magnitudes across many international large-scale assessments and over time (OECD, 2015^[20]) (Zehner, Goldhammer and Sälzer, 2018^[21]). Girls regularly outperform boys in reading assessments. In Germany, the reading gender gap used to be around 40 score points in PISA until PISA 2012; in 2015 it shrank to 21 points and 26 points in PISA 2018. The reasons both for the consistent gap and for its striking decrease along with the mode change from paper-based to computer-based assessment in PISA are likely to be related and their interplay requires further disentanglement. With regard to overall mode effects throughout the student sample, a national study examining possible effects of this mode change drew the conclusion that the measured construct of reading literacy is equivalent across the two modes of paper- and computer-based testing (Goldhammer et al., 2019^[22]). According to this study, reading items in a digital test environment tend to be slightly more difficult than in a print environment and the quantitative interpretation of trends over time should be treated with care, while the direction of the trend (positive or negative) can be seen as ascertained.

Several research findings point out aspects that can help reduce a gender gap in reading performance. For example, a closer examination of students' open-ended short text responses to PISA 2015 reading items revealed that girls tended to respond to the test questions more precisely than boys, providing more propositions (i.e. information on contents and relations; (Zehner, Goldhammer and Sälzer, 2018^[21]). Open-ended responses in reading tests like PISA carry relevant information on the students' cognitive processes during the test. It appears that typical boy responses to PISA reading questions are characterised by struggling with retrieving and integrating information, while a typical girl flexibly handles these pieces of information to formulate the responses. This finding is scaffolded by the PISA 2018 result that in Germany all gender differences in reading performance can be accounted for by boys' and girls' different knowledge of effective reading strategies (i.e. understanding and memorising a text; summarising information; and assessing the credibility of sources; cf. (OECD, 2021^[11]).

Socio-economic gap

Another systematic difference in reading performance has repeatedly been found in PISA 2018 with regard to students' socio-economic status (OECD, 2019^[23]). In Germany, this correlation is significantly higher than in the OECD average. Furthermore, students' socio-economic status is often confounded with their immigration background and the school type they attend (van Ackeren and Klemm, 2019^[24]). Given the key role of effective reading strategies for successful reading, one of the most striking findings of PISA 2018 is that Germany showed one of the largest socio-economic gaps in the index of reading strategies for assessing sources' credibility (0.65 points or higher, Figure 3). The interplay of these variables is quite complex and policy deliberations find a valid point of reference in empirical studies analysing performance differences by socio-economic background over time. For example, a recent analysis of Germany's National Educational Panel Study (NEPS) showed that performance differences by socio-economic background are already present before primary schooling and then persist throughout students' school careers (Merzele, Raith and Zierow, 2020^[17]). Policy interventions should therefore target pre-schoolers in order to prevent systematic performance gaps at school entry level. Keeping in mind the large variance of reading proficiency in Germany's 15-year-old students, a closer look into reading as an activity in different environments can help elaborate some indications for education policy and practice. Applying metacognitive strategies such as asking oneself about the main points of a text while reading it and monitoring one's progress while reading can be decisive for successful reading.

Points of reference for educational policy

Several implications can be derived from the results of the PISA 21st-Century Readers report. First, this report confirmed once more that reading proficiency does not develop automatically, but needs to be trained and practiced especially with regard to the identified risk factors shared by weak readers. Some 21% of students in Germany are below a minimum level of reading literacy required for an autonomous life and participating in society. When a significant proportion of students approaching the end of compulsory schooling are struggling readers, a look at earlier stages of learning to read is worthwhile. In the Progress in International Reading Literacy Study (PIRLS), which tests students in grade 4, Germany's relative position in the country ranking of reading scores compared to other European countries has noticeably decreased over time¹ (Bos et al., 2017^[25]). After seven rounds of PISA and four rounds of PIRLS, findings from both studies point to urgent needs for reading promotion programmes both at the primary and secondary levels in

Germany (Weis et al., 2019^[26]) (Bos et al., 2017^[25]). Furthermore, it is also important to address the issue of low reading performance as early as pre-school and throughout the schooling years (e.g. (Artelt et al., 2007^[27]) (Beck, von Dewitz and Titz, 2015^[28]).

Second, reading strategies emerged as a key factor for successful reading development and future training in reading strategies are recommended. Empirical studies have shown that classroom training sessions aimed at developing students' assessment of information reliability can improve students' critical thinking when dealing with multiple sources (Autin and Croizet, 2012^[18]) (Pérez et al., 2018^[29]).

Third, students' knowledge of effective strategies to understand, remember, summarise, and assess information can critically compensate for socio-economic background and gender gaps on reading performance. The PISA 21st-Century Readers report indicates that reading strategies have a strong mediating effect on both socio-economic and gender-related disparities in reading performance.

Fourth, strong readers are able to read linear (print) texts and, at the same time, navigate the more challenging digital environments. In fact, strong readers in PISA tend to read books in paper or balance their reading time between paper and digital. At the same time, stronger readers tend to read the news more often on digital devices or balance their reading time between paper and digital. In other words, it seems that most proficient readers are able to effectively optimise the use of digital technology, depending on the activity. For example, strong readers use digital devices to read for information such as the news or browse the Internet for schoolwork while still enjoying reading a good book on paper. Most of the high performers in reading also read longer pieces of text for school and different types of texts, including fiction books such as novels or short stories, and texts with diagrams and graphs. Reading print books means staying focused and resisting external distractions. Reading digital books means connecting multiple text sources through hypertexts, evaluating information retrieved online, and using tools like dictionaries or glossaries within the digital books (Delgado et al., 2018^[15]) (Furenes, Kucirkova and Bus, 2021^[16]). Fostering proficient readers in a digital world requires encompassing digital technologies and traditional print-reading.

To conclude, effective reading promotion programmes, especially at the secondary school level, must simultaneously address the needs of students struggling with lower-level skills such as word recognition and higher-level skills such as vocabulary and text comprehension. Teacher education and curriculum development could focus on and promote complex reading strategies to enable all students to improve and consolidate their reading literacy. It is striking that in Germany gender differences in reading can be explained by students' use of effective reading strategies; such potential can and must be unlocked by teaching and practicing these strategies more explicitly, especially at the secondary school level. Future studies should examine the effects of different types of reading instruction that help students improve their reading literacy. These should take into account that grouping practices or tracking may interfere with the effectiveness of reading promotion programmes: critical group sizes and ideal compositions of groups have yet to be determined. In contrast, there is sound scientific evidence on how to best improve reading fluency and text comprehension. Reading fluency can be improved by read-aloud methods and text comprehension by teaching reading strategies (Gold, 2018^[30]) (Lenhard, 2019^[31]). Fostering proficient readers in a digital world requires mobilising learning opportunities across the reading spectrum, encompassing digital technologies and traditional print-reading. This will enable students to learn to think critically and develop metacognitive and self-efficacy skills to navigate a technology-rich 21st century.

¹ Children in 13 EU countries performed better in reading than children in Germany in 2016 (Bos et al., 2017^[25]). Grade 4 marks the end of primary schooling in the vast majority of the German Länder (federal states) and is a valuable indicator for pre-selection achievement when students are about to be sorted into secondary school types.

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