Journal of STEAM Education
Journal of Science, Technology, Engineering, Mathematics and Art Education
2024, Jan. (Issue: 1, Volume: 7)

What Should We Understand from PISA 2022 Results?

Şahin İdil[1], Salih Gülen[2], İsmail Dönmez[3]

Editorial

Article History

Received: 5 Jan. 2024

Received in revised form:

5 Jan. 2024

Accepted: 5 Jan. 2024

Published: 30 Jan 2024

ABSTRACT

In this study, PISA 2022 results, which were held in 81 countries in 2022, have been evaluated within the scope of the courses included. In this context, a projection has been made on the PISA 2022 results consisting of sections in mathematics, science and reading comprehension. Besides, the factors that are efficient on results of the tests have also been tried to be evaluated within some criteria. It has been found that the importance of extra help carried out by teachers, using remote devices and platforms, socio-economic status and spoken language at home are still significant factors on test scores. It is recommended, for countries whose science, mathematics and reading scores are under the OECD average, to use new digital based-technologies and providing students to access to education with the required help can help them increase PISA scores.

Keywords: PISA 2022, science, mathematics, distance learning

[1]Assoc. Prof. Dr., Scientific and Technological Research Council of Turkey, Turkey, sahinidin23@gmail.com , 0000-0003-2366-913X

[2] Assoc. Prof. Dr, Mus Alparslan University, Child Development Department, s.gulen@alparslan.edu.tr, 0000-0001-5092-0495

[3]Assoc. Prof. Dr, Mus Alparslan University, Child Development Department, i.donmez@alparslan.edu.tr , 0000-0002-7792-0169

İdil, Ş., Gülen, S. & Dönmez, İ. (2024). What should we understand from PISA 2022 results?. *Journal of STEAM Education, 7*(1), 1-9. https://doi.org/10.55290/steam.1415261

INTRODUCTION

In this section, a general information about the PISA and the importance of PISA data in projecting the education systems of countries are discussed.

Programme for International Student Assessment (PISA)

PISA is an education survey conducted by the Organisation for Economic Co-operation and Development (OECD). This research is conducted by the PISA Steering Committee, which reports to the OECD Education Directorate. The main purpose of PISA is to measure students' ability to use the knowledge and skills learnt at school in daily life. PISA was first implemented in 2000 and is conducted every three years. In PISA, apart from the subject areas of *Mathematics literacy*, *Science literacy and Reading Skills*, data on students' motivation, views about themselves, learning styles, school environments and families are collected. In PISA 2022, in addition to these areas, questions measuring creative thinking skills were also asked. In PISA 2022 (MoNE, 2023) students participated in cognitive test sessions lasting two hours. In the cognitive test sessions, a total of 582 multiple-choice and self-constructed questions were used. These were mathematical literacy (234 questions), science literacy (115 questions), reading skills (197 questions) and creative thinking skills (36 questions). Students answered an average of 65 questions individually in the test sessions.

The concept of "literacy" used in PISA research is defined as finding, using, accepting and evaluating written sources in order to develop students' knowledge and potential and to enable them to participate and contribute to society more effectively. In PISA, different question types such as multiple choice, complex multiple choice, open-ended, closed-ended are used. The selection process of the schools and students who will participate in the PISA research is determined by the OECD by random method. Students participate in the questionnaire application after the Computer Based Assessment application (MoNE, 2023).

Approximately 700,000 students from 81 countries participated in PISA 2022 by being randomly selected from the universe of 29,000,000 million students. PISA 2022 was originally planned to be held in 2021, but was postponed by one year due to Covid-19 and was held in 2022.

METHOD

Our research analyses data from PISA 2022, which includes mathematics, science and reading comprehension. This includes quantitative analysis of test scores from different countries. The results are categorized according to how they compare to the OECD average. This categorization helps to understand the relative performance of different countries in the key areas assessed by PISA. Our study also includes an assessment of various factors that may influence PISA results. These factors include the role of extra teacher assistance, use of remote devices and platforms, socio-economic status and language spoken at home. It uses PISA's mathematics, science and reading literacy assessment frameworks based on the literacy concepts defined in PISA. Part of the methodology includes analysis of responses to PISA's questionnaire items, in particular students' experiences during the COVID-19 pandemic and

technology access assessed. It also focused on interdisciplinary work, socio-economic analysis, the creative thinking process.

RESULTS

In this section, findings related to reading, mathematics and science in PISA 2022 are presented.

PISA 2022 data for Reading

PISA 2022 results within reading are given under table 1. Based on the exam, the average of the test of science is 475 (OECD, 2023).

Table 1. PISA 2022 results for Reading (OECD, 2023)

		Reading score 2022	Reading score change from 2018			Reading score 2022	Reading score change from 2018
Above the OECD average	Singapore	543	-7	Below the OECD average	Greece	438	-19
	Ireland*	516	-2		Iceland	436	-38
	Japan	516	12		Uruguay	430	3
	Korea	515	1		Brunei Darussalam	429	21
	Chinese Taipei	515	13		Romania	428	1
	Estonia	511	-12		*Ukrainian regions (18 of 27)*	428	N.A
	Macao (China)	510	-15		Qatar	419	12
	Canada*	507	-13		United Arab Emirates	417	-14
	United States*	504	-1		Mexico	415	-5
	New Zealand*	501	-5		Costa Rica	415	-11
	*Hong Kong (China)**	500	-25		Moldova	411	-13
	Australia*	498	-5		Brazil	410	-3
	United Kingdom*	494	-10		Jamaica*	410	N.A
	Finland	490	-30		Colombia	409	-4
	Denmark*	489	-12		Peru	408	8
	Poland	489	-23		Montenegro	405	-16
	Czech Republic	489	-2		Bulgaria	404	-16
	Sweden	487	-19		Argentina	401	-1
	Switzerland	483	-1		Panama*	392	15
	Italy	482	5		Malaysia	388	-27
No difference	Austria	480	-4		Kazakhstan	386	-1
	Germany	480	-18		Saudi Arabia	383	-17
	Belgium	479	-14		Thailand	379	-14
	Portugal	477	-15		Mongolia	378	N.A
	Norway	477	-23		Guatemala	374	5
	Croatia	475	-3		Georgia	374	-6
	Latvia*	475	-4		Paraguay	373	3
	Spain	474	N.A		*Baku (Azerbaijan)*	365	-24
	France	474	-19		El Salvador	365	N.A
	Israel	474	3		Indonesia	359	-12
	Hungary	473	-3		North Macedonia	359	-34
	Lithuania	472	-4		Albania	358	-47
Below	Slovenia	469	-27		Dominican Republic	351	10
	Viet Nam**	462	N.A		*Palestinian Authority*	349	N.A
	Netherlands*	459	-26		Philippines	347	7
	Türkiye	456	-10		*Kosovo*	342	-11
	Chile	448	-4		Jordan	342	N.A
	Slovak Republic	447	-11		Morocco	339	-20
	Malta	445	-3		Uzbekistan	336	N.A
	Serbia	440	1		Cambodia	329	8

In PISA, different dimensions are defined to measure reading skills. These are: Different text types- Cognitive processes in which the reader interacts with the text- Questions and tasks of different difficulty levels (MoNE, 2023). It is clearly seen in Table 1 that there are three different categories. Those categories are as above the OECD average, no difference and below

the OECD average. We understand that the majority of the participated countries' PISA 2022 results for reading are under OECD average. The students from Singapore (543) are ranked on the top of the list for reading and students from Ireland are located 2nd of the list. It is also seen that countries from Asia and Europe are located above the OECD average.

PISA 2022 reading test scores are important in terms of assessing students' reading comprehension and interpretation skills. The outputs given in Table 1 are important in terms of revealing whether the students of the countries participating in the test can understand a problem given in their own language. According to the PISA results, the reading test scores of the students of 20 countries (countries located in Europe, Asia, America and Australia) were above the OECD, while the reading test scores of the students of 12 countries (except Israel, the other countries are located in Europe) were at the OECD average. It was revealed that the countries with test scores below the OECD average were more in this test area. Among these countries below the OECD average, developed countries such as the Netherlands and Iceland and countries such as Türkiye, which have recently made significant investments in education, are among the results.

PISA 2022 data for Mathematics

PISA 2022 results within mathematics are given under table 2. Based on the exam, the average of the test of mathematics is 472 (OECD, 2023).

The mathematics assessment framework used in PISA 2022 defines the theoretical foundations of the assessment of mathematics in PISA. This definition is based on the concept of mathematical literacy and links mathematical reasoning with the processes in the problem-solving cycle. In this respect, skills such as mathematical reasoning, problem solving and interdisciplinary thinking can also be associated with 21st century skills. When Table 2 is analysed, it is seen that the countries (23 countries) that scored above the OECD average in the mathematics test in PISA 2022 are generally developed countries in Asia and Europe. Two countries outside these continents, Australia and New Zealand, performed above the OECD average score. Some countries, such as Lithuania, Germany, France, Spain, Hungary, Portugal, Italy, Italy, Vietnam and Norway (6 countries), had maths test scores in line with the OECD average. Most of the countries (52 countries) that took part in the mathematics test had average scores below the OECD average. It can be said that these countries' investments in mathematics education before and during the pandemic were also effective in the emergence of these results. Benefiting from digital technologies in the lesson, the frequency and duration of using digital technology tools and platforms during Covid-19, teachers' effective communication with students during the Covid-19 pandemic, and students' use of technology in their individual studies can be expressed as variables affecting mathematics test scores.

Table 2. PISA 2022 results for Mathematics (OECD, 2023)

		Math score 2022	Math score change from 2018			Math score 2022	Math score change from 2018
Above the OECD average	Singapore	575	6	Below the OECD average	*Ukrainian regions (18 of 27)*	441	N.A
	Macao (China)	552	-6		Serbia	440	-8
	Chinese Taipei	547	16		United Arab Emirates	431	-4
	*Hong Kong (China)**	540	-11		Greece	430	-21
	Japan	536	9		Romania	428	-2
	Korea	527	1		Kazakhstan	425	2
	Estonia	510	-13		Mongolia	425	N.A
	Switzerland	508	-7		Bulgaria	417	-19
	Canada*	497	-15		Moldova	414	-6
	Netherlands*	493	-27		Qatar	414	0
	Ireland*	492	-8		Chile	412	-6
	Belgium	489	-19		Uruguay	409	-9
	Denmark*	489	-20		Malaysia	409	-32
	United Kingdom*	489	-13		Montenegro	406	-24
	Poland	489	-27		*Baku (Azerbaijan)*	397	-23
	Austria	487	-12		Mexico	395	-14
	Australia*	487	-4		Thailand	394	-25
	Czech Republic	487	-12		Peru	391	-9
	Slovenia	485	-24		Georgia	390	-8
	Finland	484	-23		Saudi Arabia	389	16
	Latvia*	483	-13		North Macedonia	389	-6
	Sweden	482	-21		Costa Rica	385	-18
	New Zealand*	479	-15		Colombia	383	-8
No difference	Lithuania	475	-6		Brazil	379	-5
	Germany	475	-25		Argentina	378	-2
	France	474	-21		Jamaica*	377	N.A
	Spain	473	N.A		Albania	368	-69
	Hungary	473	-8		*Palestinian Authority*	366	N.A
	Portugal	472	-21		Indonesia	366	-13
	Italy	471	-15		Morocco	365	-3
	Viet Nam	469	N.A		Uzbekistan	364	N.A
	Norway	468	-33		Jordan	361	-39
	Malta	466	-6		Panama*	357	4
	United States*	465	-13		*Kosovo*	355	-11
Below	Slovak Republic	464	-22		Philippines	355	2
	Croatia	463	-1		Guatemala	344	10
	Iceland	459	-36		El Salvador	343	N.A
	Israel	458	-5		Dominican Republic	339	14
	Türkiye	453	0		Paraguay	338	11
	Brunei Darussalam	442	12		Cambodia	336	12

It is thought that various factors are effective in the closure of schools during the Covid-19 process in the emergence of these scores of the countries in the reading test area of PISA 2022. Within the scope of PISA 2022, this situation was also asked to the students through the questionnaire items. It is thought that the problems that students are exposed to within the scope of distance learning activities when schools are closed during the pandemic process, the problems that students face in the processes in which they are responsible for their own learning when they are at home, and the competence and competence of teachers to follow their students within the scope of the course while the school is closed and to solve problems have an important place. In this context, it is important to consider these variables in the emergence of reading test scores in terms of countries. In addition to these variables, the role of socio-cultural and socio-economic levels of families in the emergence of students' reading test scores may also need to be considered (Fan & Williams, 2010; Hill & Tyson, 2009; Juang & Silbereisen, 2002). It was revealed that socio-economic status was a determining factor of mathematics

performance in all countries participating in PISA 2022 (MoNE, 2023). Socio-economically advantaged students scored 93 points more in mathematics than disadvantaged students on average across OECD countries (OECD, 2023b). Another result within mathematics to be stated is that immigrant students' test scores have been found higher than non-immigrant students in eight countries once students' socio-economic status and the language they speak at home had been accounted for. The number of migrant students varies from country to country participating in PISA 2022. But one thing is important that we are able to say that if the immigrant background students have the similar, in some countries, opportunities like non-immigrant students, the mathematics test scores could change in favour of immigrant students. We should understand with this result obtained by PISA 2022 that socio-economic status, spoken language at home, learning devices have still effective on mathematics achievement.

PISA 2022 data for Science

PISA 2022 results within science are given under table 3. Based on the exam, the average of the test of science is 485 (OECD, 2023).

Table 3. PISA 2022 results for Science (OECD, 2023)

		Science score 2022	Science score change from 2018			Science score 2022	Science score change from 2018
Above the OECD average	Singapore	561	10	Below the OECD average	Iceland	447	-28
	Japan	547	17		Brunei Darussalam	446	15
	Macao (China)	543	0		Chile	444	0
	Chinese Taipei	537	22		Greece	441	-11
	Korea	528	9		Uruguay	435	10
	Estonia	526	-4		Qatar	432	13
	*Hong Kong (China)**	520	4		United Arab Emirates	432	-2
	Canada*	515	-3		Romania	428	2
	Finland	511	-11		Kazakhstan	423	26
	Australia*	507	4		Bulgaria	421	-3
	New Zealand*	504	-4		Moldova	417	-12
	Ireland*	504	8		Malaysia	416	-21
	Switzerland	503	7		Mongolia	412	N.A
	Slovenia	500	-7		Colombia	411	-2
	United Kingdom*	500	-5		Costa Rica	411	-5
	United States*	499	-3		Mexico	410	-9
	Poland	499	-12		Thailand	409	-17
	Czech Republic	498	1		Peru	408	4
	Latvia*	494	7		Argentina	406	2
	Denmark*	494	1		Montenegro	403	-12
	Sweden	494	-6		Brazil	403	-1
	Germany	492	-11		Jamaica*	403	N.A
	Austria	491	1		Saudi Arabia	390	4
	Belgium	491	-8		Panama*	388	23
No difference	Netherlands*	488	-15		Georgia	384	1
	France	487	-6		Indonesia	383	-13
	Hungary	486	5		*Baku (Azerbaijan)*	380	-18
	Spain	485	N.A		North Macedonia	380	-33
	Lithuania	484	2		Albania	376	-41
	Portugal	484	-7		Jordan	375	N.A
	Croatia	483	10		El Salvador	373	N.A
Below	Norway	478	-12		Guatemala	373	8
	Italy	477	9		*Palestinian Authority*	369	N.A
	Türkiye	476	8		Paraguay	368	10
	Viet Nam	472	N.A		Morocco	365	-11
	Malta	466	9		Dominican Republic	360	25
	Israel	465	3		*Kosovo*	357	-8
	Slovak Republic	462	-2		Philippines	356	-1
	Ukrainian regions (18 of 27)	450	N.A		Uzbekistan	355	N.A
	Serbia	447	8		Cambodia	347	17

In PISA, science literacy focuses on the capacity of 15-year-old students to demonstrate types of knowledge appropriately in personal, local, national and global contexts. In this respect, we can state that the science literacy assessed in PISA refers to a wider scope than the science curriculum taught in schools. When Table 3 is analysed, it is seen that some countries' scores are above the OECD average (485) and some countries' scores are not statistically different in science. In addition, it was determined that the science scores of the majority of the countries that took the test within the scope of the PISA 2022 science test were below the OECD average. The countries with science test scores above the OECD average are from Asia (Japan, Chinese Taipei, Korea, Hong Kong (China), Macao (China), Europe (Poland, Latvia, England, Germany, Belgium, Sweden, Switzerland, Ireland, Slovenia, Austria and Czechia), the Americas (USA and Canada) and Australia (Australia).

The highest science score was 561 (Singapore) and the lowest was 491 (Belgium). Considering the PISA 2022 science test results above the OECD 2022 average, it can be said that the ranking is formed by developed countries. In addition, it is seen that some countries have increased their science scores numerically since the last exam in 2018. These countries are Japan, Singapore, Chinese Taipei, Korea, Australia, Ireland, Ireland, Switzerland, Czechia, Lithuania, Denmark and Austria. In terms of PISA 2022 science results, it was determined that although some countries' science scores were numerically below the OECD average (485), there was no statistically significant difference. For this reason, countries such as Lithuania (484), Portugal (484) and Croatia (484) were also considered within the OECD average. According to the science test scores, although 24 countries' scores were above the OECD average and 7 countries' scores were determined as the OECD average, the science scores of 50 countries participating in the test remained below the OECD average (485). When the countries in Table 3 are taken into consideration, it is seen that the ranking in terms of 2022 science test score is mostly composed of developing countries, but there are also developed countries such as Italy, Iceland and Norway and countries such as Turkey, Azerbaijan, Romania, Serbia, Argentina and Brazil.

Creative Thinking

PISA 2022 was the first time that creative thinking was assessed as an innovative field. Creative thinking is defined as students' ability to engage productively in the generation, evaluation and improvement of ideas that can result in original and effective solutions, advances in knowledge and impactful expressions of imagination (OECD, 2023b).

It can be argue that the aim of the assessing creative thinking is to find out how students attitude and performance associate with creative thinking vary along participating countries

CONCLUSIONS AND DISCUSSIONS

OECD (2023c), some PISA participant countries and economies saw a large share of all 15-year-olds with basic proficiency in reading, mathematics and science and achieve high levels of socio-economic fairness: Canada, Denmark, Finland, Ireland, Korea, Japan, Hong Kong (China), Latvia, Macao (China) and the United Kingdom. While socioeconomic status still

remains an important predictor of performance in those and other OECD countries and economies, education in those countries can be considered very much equitable.

It is known that technology has a crucial role in education systems within achieve given tasks. This situation is seen in PISA 2022 results. Using some technology-based tools and platforms such as LMS, school learning digital platforms, video communication programs and online programs had positive effect on students' learning process. PISA 2022 results showed that student who spent up one hour per day on digital tools for learning process in school scored 14 points higher in maths that students who spent no time. Besides, PISA results showed that students rarely had problems with logistical aspects (OECD, 2023b) such as access to a digital device, internet access. But more students struggled with a lack of motivation and support and had some problems to find someone who were able to help them with their homework, understanding school assignments. This result gives us very significant data that the use of technology in education can be a very efficient tool to achieve given learning outcomes. Within this scope, it can be said that distance teaching materials and platforms should be used effectively. Although PISA 2022 results reveal that the use of digital technologies do not affect the majority of the students in success with reading, science and mathematics. Because PISA 2022 focuses more on to access to internet and using digital devices such as laptop, computer and tablet. It is known that the majority of countries used online tools to maintain education remotely when the school closure started. At this point, it is necessary to point out how distance learning is realised in terms of students' performance in reading, science and mathematics considering the period when schools are closed. The quality of distance learning within remote learning and teaching system is important to provide students with their self-learning. It can be recommended that what distance learning methods, techniques, tools, platforms were used during the school closures for OECD countries within PISA. Another significant indicator within PISA 2022 was the participation of the teacher into the teaching and learning process. According to the data taken by PISA 2022 results (OECD, 2023b) state that teachers' support is especially important to students. The availability of teachers to help students in need had the most powerful relationship to mathematics performance across the OECD, compared to other experiences linked to novel Covid-19 school closure. Idin (2011) revealed that student achievement increases in the case of additional help in education related to science and technology course. In this context, extra teacher supports could be powerful in favour of student's performance in science. Besides, socio-economic status and spoken language have still remain significant factors on the learning science, mathematics and reading. It has been highlighted in PISA 2022 that immigrant background students have increased between 2012 and 2022, 23 out of 40 countries with more than 5% of students. The immigrant background students in the same period between (OECD, 2023b) 10 and 12 percentage points in Singapore, Switzerland, Austria and Germany. Another important finding is that immigrant background students have been declined just in Macao (Chine), the United Arab Emirates and Estonia between 2018 and 2022. This result is also interesting that in PISA 2022 these three countries, and no more than three percentage points, are successful and located on the top of the list. However, we also know from PISA 2022 report that the number of immigrant background students has rarely declined among PISA-participating countries between 2018 and 2022. This result tells us that all PISA-participating countries should be aware of the immigrant students and can increase their efforts to integrate those students into their education systems. This point

is important because some countries have already achieved socio-economic fairness for their students. Those countries, (OECD, 2023a) Ireland, Japan, Korea, Latvia, Macao (China), Hong Kong (China), Finland, Canada, United Kingdom and Denmark, education systems are rather equitable. We see that those countries' test scores are also ranked on OECD average. In addition to this, it has been found that some countries' results are stable in their PISA performance. Within this context, Colombia, Macao (China), Qatar and Peru improved on average in science, mathematics and reading over the full period they participated in PISA. Besides, Türkiye, Republic of Moldova, Israel, Singapore improved in two out of three subjects. This result also shows us the important of continuity to education systems to get success in science, mathematics and reading.

DATA AVAILABILITY

Conflict of Interest: There is no conflict interest between editors.

REFERENCES

Fan, W., & Williams, C. M. (2010). The effects of parental involvement on students' academic self-efficacy, engagement and intrinsic motivation. *Educational Psychology, 30*(1), 53–74.

Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology, 45(*3), 740–763.

Idin, S. (2011). The effects of science and technology course organised primary schools courses at weekend for 7 grade students' achievement test. Master Thesis, The Department of Primary Science Education, Van Yüzüncü Yıl University.

Juang, L. P. & Silbereisen, R. K. (2002). The relationship between adolescent academic capability beliefs, parenting and school grades. *Journal of Adolescence, 25*(1), 3–18.

MoNE (2023). PISA 2022 Türkiye Raporu. [PISA 2022 Türkiye Report] Retrieved from: https://pisa.meb.gov.tr/meb_iys_dosyalar/2023_12/05125555_pisa2022_rapor_051223.pdf

OECD (2023a). *PISA 2022 Results (Volume II). Learning During-and from-Distruption* , PISA OECD Publishing, Paris, https://doi.org/10.1787/a97db61c-en

OECD (2023b). *PISA 2022 Results (Volume I). The State of Learning and Equity in Education*, PISA OECD Publishing, Paris, https://doi.org/10.1787/53f23881-en.

OECD (2023c). PISA 2022 Results. Retrieved from : https://www.oecd.org/pisa/OECD_2022_PISA_Results_Comparing%20countries%E2%80%99%20and%20economies%E2%80%99%20performance%20in%20mathematics.pdf