CHILD ONLINE SAFETY INDEX

2023 Methodology Report

DQ Institute™
Global Standards for Digital Intelligence

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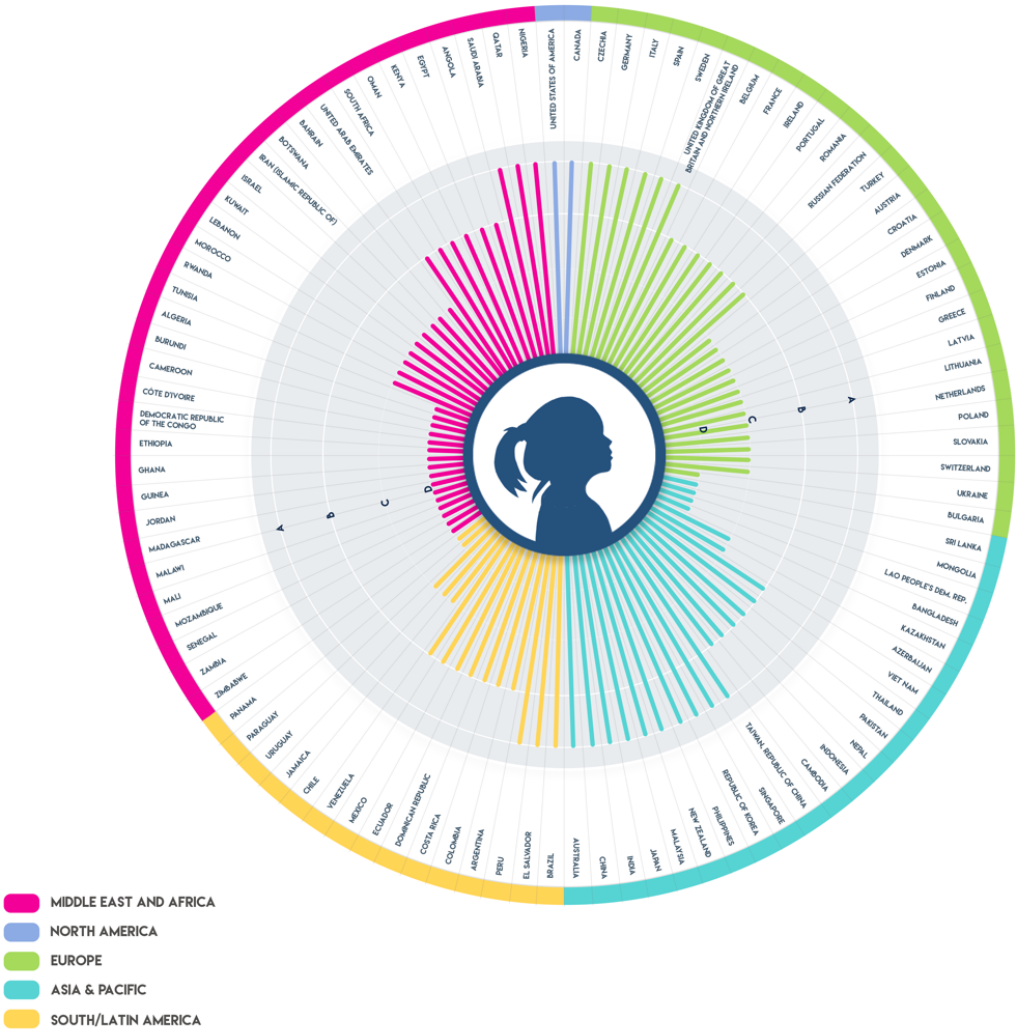


ABOUT THE 2023 COSI REPORT

The Child Online Safety Index (COSI) serves as a national-level metric to provide a snapshot to help all stakeholders involved in child online safety to understand the status of child online safety in their country.

The COSI was developed through the 'Outsmart Cyber-Pandemic' Report, which was published by the DQ Institute in collaboration with the World Economic Forum, Singtel, and more than 100 partners. The report revealed, for the first time, the high and consistent prevalence of cyber-risks among young children across countries and cultures—56% of 8–12-year-olds across 29 countries

were exposed to cyber-risk behaviors, such as cyberbullying, video game addiction, offline meetings, and online sexual behaviors.

The 2018 'Outsmart Cyber-Pandemic' report highlighted the need for a comprehensive global index to track and monitor the national status of child online safety, involving all stakeholders in each respective country. The inaugural COSI was launched on Safer Internet Day in 2020 (February 11, 2020). Subsequently, the 2022 COSI marked the second iteration of this publication, and the 2023 COSI represents the third installment in this series. The 2022 COSI examined the global status of child online safety post-COVID-19 pandemic. A notable finding from the 2022 COSI was that, contrary to the common belief that exposure to cyber-risk among children would significantly increase due to COVID lockdowns, it actually decreased by 4-7% from 2019 to 2020, even though excessive screen time and underage social media access increased by 10-15%. The rate then surged back to 71% in 2022, and the 2023 COSI findings emphasize that cyber-risks among children have returned to the pre-COVID-19 average of 67%. In summary, these results underscore that the 'cyber-pandemic' among children is a persistent technological issue rather than a circumstantial one.

The 2023 COSI report used the same scoring methodology developed in 2022, with the inclusion of four new indicators in 2023. However, instead of providing a global ranking of nations, the 2023 COSI offers a four-scale rating system: A=Top Quartile, B=2nd Quartile, C=3rd Quartile, and D=4th Quartile. This comprehensive tool empowers nations to assess and identify areas for improvement in the online safety of their children and youth, involving key stakeholders such as children, families, schools, ICT companies, and the soft and hard infrastructures of government bodies.

The 2023 COSI report is based on data collected from a substantial sample of 351,376 children and adolescents representing 100 different countries. Data sources include the DQ Institute's impact tracker, as well as publicly accessible external sources, such as international research projects and publications.

THE 2023 COSI FRAMEWORK

The COSI score represents the overall level of a nation's performance on child online safety measures. The COSI examines the child online safety performances across 6 stakeholders—namely, children, families, schools, ICT companies, and soft and hard infrastructures of the government. Each stakeholder score is measured based on the 12 topic scores that belong to each stakeholder, and each topic score is measured based on the 39 indicator scores that belong to each topic, in a hierarchical structure (See Figure 1 and Table 1 for better visualization).

FIGURE 1. THE 2023 COSI FRAMEWORK

Stakeholder scores, rigorously defined by the Performance Level Descriptors (PLDs), are designed to give policymakers and national leaders a better understanding of their countries' performance on child online safety. Topic scores are the indicators of performance in different areas of stakeholders' efforts. The indicator scores can be used to develop assessment instruments, learning curriculum, and/or tasks for relevant groups within each stakeholder.

TABLE 1. THE 2023 COSI FRAMEWORK: INDICATORS, TOPICS, AND STAKEHOLDERS

6 STAKEHOLDERS					
Stakeholder 1: Children's Safe Use of Technology	Stakeholder 2: Family Support for Child Online Safety	Stakeholder 3: School Digital Citizenship Education	Stakeholder 4: ICT Company Responsibility for Child Online Safety	Stakeholder 5: Government Policies and Regulation for Child Online Safety	Stakeholder 6: Technology Infrastructure for Child Online Safety
12 TOPICS					
Cyber-Risks Avoidance of Children Disciplined Technology Use of Children Digital Citizenship Skills of Children	Digital Parenting	School Digital Citizenship Education and Policies	Safety by Design Public Trust Toward Digital Platform	Child Online Protection Regulatory Framework Privacy & Safety Frameworks and Regulation	Universal Accessibility Internet Access at Home and Schools Cybersecurity Infrastructure
39 INDICATORS					
Avoidance of cyber-bullying and -victimization Avoidance of personal data misuse Avoidance of pathological overuse of technology Avoidance of risky contact Avoidance of risky content Avoidance of excessive screen time Avoidance of technology overuse Avoidance of underage social media use Digital citizen identity skills of children Balanced use of technology skills of children Behavioral cyber-risk management skills of children Personal cyber security management skills of children Digital empathy skills of children Digital footprint management skills of children Media and info literacy skills of children Privacy management skills of children	Parental mediation for children and adolescents Trust networks to support children at cyber-risks	School digital citizenship education Governmental support for digital literacy	CSAM (Child Sexual Abuse Materials) Reporting Trust in government websites and apps Trust in ICT sector Trust in private sector website and apps	Legal framework against CSAM Legal framework against online grooming Privacy frameworks and regulation Child Data Processing	Internet access Device access Internet affordability Internet quality Network coverage Device access - School Internet access - School Device access - Home Internet access - Home Global Cybersecurity Index Secure Internet Servers

PERFORMANCE LEVEL DESCRIPTORS (PLDS)

Performance level descriptors are a means of describing performance in terms of levels or categories of performance. For the COSI scores, Stakeholder and Topic outcomes are reported in terms of four levels of performance: Level A: Top Quartile, Level B: 2nd Quartile, Level C: 3rd Quartile, and Level D: 4th Quartile.

The PLDs for Stakeholder and Topic scores can be considered policy PLDs designed for policymakers. They are general descriptors that articulate the goals and rigor for the final performance standards. These descriptors set the tone for the subsequent descriptors for Indicator scores, which can be considered as range PLDs. They are content-specific descriptors that may be used by corresponding stakeholders to guide assessment or learning development and/or resource enhancement.

	LEVEL A	LEVEL B	LEVEL C	LEVEL D
COSI SCORE	Stakeholders have shown thorough performance on child online safety measures on average	Stakeholders have shown above-par performance on child online safety measures on average	Stakeholders have shown partial performance on child online safety measures on average	Stakeholders have shown minimal performance on child online safety measures on average
STAKEHOLDER 1: CHILDREN'S SAFE USE OF TECHNOLOGY				
Stakeholder 1: Children's Safe Use of Technology	Level of individual competencies for child online safety is high, compared to the global average	Level of individual competencies for child online safety is slightly above or about the global average	Level of individual competencies for child online safety is slightly below or about the global average	Level of individual competencies for child online safety is low, compared to the global average
Topic 1: Cyber-Risks Avoidance of Children	Avoidance of various cyber-risks among children and adolescents is high, compared to the global average	Avoidance of various cyber-risks among children and adolescents is slightly above or about the global average	Avoidance of various cyber-risks among children and adolescents is slightly below or about the global average	Avoidance of various cyber-risks among children and adolescents is low, compared to the global average
Indicator 1: Avoidance of Cyber-Bullying and/or Cyber-Victimization	% of children and adolescents who have been involved with cyber-bullying and/or cyber-victimization is below 31%	% of children and adolescents who have been involved with cyber-bullying and/or cyber-victimization slightly below or about the global average	% of children and adolescents who have been involved with cyber-bullying and/or cyber-victimization is slightly over or about the global average	% of children and adolescents who have been involved with cyber-bullying and/or cyber-victimization is over 55%
Indicator 2: Avoidance of Misuse of Personal Data	% of children and adolescents who have been exposed to cyber threats is below 19%	% of children and adolescents who have been exposed to cyber threats is between 19-28%	% of children and adolescents who have been exposed to cyber threats is between 28-40%	% of children and adolescents who have been exposed to cyber threats is over 40%
Indicator 3: Avoidance of Pathological Overuse of Technology	% of children and adolescents who have been at high risk of technology disorder is below 13%	% of children and adolescents who have been at high risk of technology disorder is slightly below or about the global average	% of children and adolescents who have been at high risk of technology disorder is slightly above or about the global average	% of children and adolescents who have been at high risk of technology disorder is over 24%

Indicator 4: Avoidance of Risky Contact	% of children and adolescents who have been exposed to risky contact is below 18%	% of children and adolescents who have been exposed to risky contact is slightly below or about the global average	% of children and adolescents who have been exposed to risky contact is slightly above or about the global average	% of children and adolescents who have been exposed to risky contact is over 36%
Indicator 5: Avoidance of Risky Content	% of children (age 8-12) who have been exposed to risky (sexual or violent) content is below 23%	% of children (age 8-12) who have been exposed to risky (sexual or violent) content is slightly below or about the global average	% of children (age 8-12) who have been exposed to risky (sexual or violent) content is slightly above or about the global average	% of children (age 8-12) who have been exposed to risky (sexual or violent) content is over 39%
Topic 2: Disciplined Technology Use of Children	Level of excessive or illegal use of digital technology among children is low compared to the global average	Level of excessive or illegal use of digital technology among children slightly below or about the global average	Level of excessive or illegal use of digital technology among children slightly above or about the global average	Level of excessive or illegal use of digital technology among children is high, compared to the global average
Indicator 6: Avoidance of Excessive Screen Time	% of children and adolescents who have excessive screen time for entertainment use (>= 30 hours per week) is below 33%	% of children and adolescents who have excessive screen time for entertainment use (>= 30 hours per week) is between 33-49%	% of children and adolescents who have excessive screen time for entertainment use (>= 30 hours per week) is between 49-61%	% of children and adolescents who have excessive screen time for entertainment use (>= 30 hours per week) is over 61%
Indicator 7: Avoidance of Technology Overuse	% of children and adolescents who show gaming disorder symptoms is below 10%	% of children and adolescents who show gaming disorder symptoms is between 10-13%	% of children and adolescents who show gaming disorder symptoms is between 13-31%	% of children and adolescents who show gaming disorder symptoms is over 31%
Indicator 8: Avoidance of Underage Social Media Use	% of children (age 8-12) who have illegally accessed social media is below 42%	% of children (age 8-12) who have illegally accessed social media is between 42-54%	% of children (age 8-12) who have illegally accessed social media is between 54-63%	% of children (age 8-12) who have illegally accessed social media is over 63%
Topic 3: Digital Citizenship Skills of Children	DQ digital citizenship scores of children and adolescents is high, compared to the global average	DQ digital citizenship scores of children and adolescents is above-par compared to the global average	DQ digital citizenship scores of children and adolescents is below-par compared to the global average	DQ digital citizenship scores of children and adolescents is low, compared to the global average
Indicator 9: Digital Citizen Identity Skills of Children	Average DQ score for digital citizen identity skills is higher than 60	Average DQ score for digital citizen identity skills is between 52 and 60	Average DQ score for digital citizen identity skills is between 48 and 52	Average DQ score for digital citizen identity skills is lower than 48
Indicator 10: Balanced Use of Technology Skills of Children	Average DQ score for balanced use of technology skills is higher than 62	Average DQ score for balanced use of technology skills is between 48 and 62	Average DQ score for balanced use of technology skills is lower than 48	Average DQ score for balanced use of technology skills is lower than 48
Indicator 11: Behavioral Cyber-Risk Management Skills of Children	Average DQ score for behavioral cyber-risk management skills is higher than 66	Average DQ score for behavioral cyber-risk management skills is between 46 and 66	Average DQ score for behavioral cyber-risk management skills is lower than 46	Average DQ score for behavioral cyber-risk management skills is lower than 46
Indicator 12: Personal Cyber Security Management Skills of Children	Average DQ score for personal cyber security management skills is higher than 61	Average DQ score for personal cyber security management skills is between 50 and 61	Average DQ score for personal cyber security management skills is lower than 50	Average DQ score for personal cyber security management skills is lower than 50

Indicator 13: Digital Empathy Skills of Children	Average DQ score for digital empathy skills is higher than 66	Average DQ score for digital empathy skills is between 46 and 66	Average DQ score for digital empathy skills is lower than 46	Average DQ score for digital empathy skills is lower than 46
Indicator 14: Digital Footprint Management Skills of Children	Average DQ score for digital footprint management skills is higher than 61	Average DQ score for digital footprint management skills is between 49 and 61	Average DQ score for digital footprint management skills is lower than 49	Average DQ score for digital footprint management skills is lower than 49
Indicator 15: Media and Info Literacy Skills of Children	Average DQ score for media and info literacy skills is higher than 64	Average DQ score for media and info literacy skills is between 46 and 64	Average DQ score for media and info literacy skills is lower than 46	Average DQ score for media and info literacy skills is lower than 46
Indicator 16: Privacy Management Skills of Children	Average DQ score for privacy management skills is higher than 63	Average DQ score for privacy management skills is between 49 and 63	Average DQ score for privacy management skills is between 47 and 49	Average DQ score for privacy management skills is lower than 47
STAKEHOLDER 2: FAMILY SUPPORT				
Stakeholder 2: Family Support for Child Online Safety	Level of family support for child online safety is high, compared to the global average	Level of family support for child online safety is above-par compared to the global average	Level of family support for child online safety is below-par compared to the global average	Level of family support for child online safety is low, compared to the global average
Topic 4: Digital Parenting	Level of digital parenting and family support for children is high, compared to the global average	Level of digital parenting and family support for children is above-par compared to the global average	Level of digital parenting and family support for children is below-par compared to the global average	Level of digital parenting and family support for children is low, compared to the global average
Indicator 17: Parental Mediation for Children and Adolescents	% of parents who conduct digital parenting for child online safety is over 57%	% of parents who conduct digital parenting for child online safety is between 54% and 57%	% of parents who conduct digital parenting for child online safety is between 50% and 54%	% of parents who conduct digital parenting for child online safety is below 50%
Indicator 18: Trust Networks to Support Children at Cyber-Risks	% of children (age 8-12) who receive support from family in the event of cyber-risk is over 58%	% of children (age 8-12) who receive support from family in the event of cyber-risks is between 53-58%	% of children (age 8-12) who receive support from family in the event of cyber-risks is between 50-53%	% of children (age 8-12) who receive support from family in the event of cyber-risks is below 50%
STAKEHOLDER 3: SCHOOL DIGITAL CITIZENSHIP EDUCATION				
Stakeholder 3: School Education for Child Online Safety	Level of education for child online safety is high compared to the global average	Level of education for child online safety is above-par compared to the global average	Level of education for child online safety is below-par compared to the global average	Level of education for child online safety is low compared to the global average
Topic 5: School Digital Citizenship Education	Level of digital literacy/cyber safety education at schools is high compared to the global average	Level of digital literacy/cyber safety education at schools is above-par compared to the global average	Level of digital literacy/cyber safety education at schools is below-par compared to the global average	Level of digital literacy/cyber safety education at schools is low, compared to the global average
Indicator 19: School Digital Citizenship Education	% of children and adolescents whose schools teach them about cyber safety is over 89%	% of children and adolescents whose schools teach them about cyber safety is between 86-89%	% of children and adolescents whose schools teach them about cyber safety is below 80-86%	% of children and adolescents whose schools teach them about cyber safety is below 80%

Indicator 20: Governmental Support for Digital Literacy	There is a current government plan/strategy that addresses digital literacy for students and training for teachers	There is a government plan/strategy that addresses digital literacy for students, but no training for teachers (or the plan is outdated)	There is no current government plan/strategy that addresses digital literacy for students or training for teachers	There is no current government plan/strategy that addresses digital literacy for students or training for teachers
STAKEHOLDER 4: ICT COMPANY RESPONSIBILITY				
Stakeholder 4: ICT Company Responsibility for Child Online Safety	Level of companies' commitment to child online safety through Digital-ESG is high compared to the global average	Level of companies' commitment to child online safety through Digital-ESG is at about the global average	Level of companies' commitment to child online safety through Digital-ESG is low compared to the global average	Level of companies' commitment to child online safety through Digital-ESG is low compared to the global average
Topic 6: Safety by Design	There are multiple levels of CSAM reporting in legal frameworks for ICT companies	There are one or two levels of CSAM reporting in legal frameworks for ICT companies	There are no levels of CSAM reporting in legal frameworks for ICT companies	There are no levels of CSAM reporting in legal frameworks for ICT companies
Indicator 21: CSAM (Child Sexual Abuse Materials) Reporting	There are multiple levels of CSAM reporting in legal frameworks for ICT companies	There are one or two levels of CSAM reporting in legal frameworks for ICT companies	There are no levels of CSAM reporting in legal frameworks for ICT companies	There are no levels of CSAM reporting in legal frameworks for ICT companies
Topic 7: Public Trust Toward Digital Platforms	Level of public trust in public and private digital platforms is high compared to the global average	Level of public trust in public and private digital platforms is above-par compared to the global average	Level of public trust in public and private digital platforms is below-par compared to the global average	Level of public trust in public and private digital platforms is low, compared to the global average
Indicator 22: Trust in Government Websites and Apps	% of people with trust in government websites and apps is over 62%	% of people with trust in government websites and apps is between 52-62%	% of people with trust in government websites and apps is below 48-52%	% of people with trust in government websites and apps is below 48%
Indicator 23: Trust in ICT Sector	% of people with trust in ICT websites and apps is over 60%	% of people with trust in ICT websites and apps is between 53-60%	% of people with trust in ICT websites and apps is between 48-53%	% of people with trust in ICT websites and apps is below 48%
Indicator 24: Trust in Private Sector Website and Apps	% of people with trust in private sector websites and apps is over 61%	% of people with trust in private sector websites and apps is between 54-61%	% of people with trust in private sector websites and apps is between 48-54%	% of people with trust in private sector websites and apps is below 48%
STAKEHOLDER 5: GOVERNMENT POLICIES AND REGULATION				
Stakeholder 5: Government Policies and Regulation for Child Online Safety	Level of regulatory enforcement for child online safety is high, compared to the global average	Level of regulatory enforcement for child online safety is the global average	Level of regulatory enforcement for child online safety is low compared to the global average	Level of regulatory enforcement for child online safety is low compared to the global average
Topic 8: Child Online Protection Regulatory Framework	Level of regulatory enforcement for CSAM and online grooming is high compared to the global average	Level of regulatory enforcement for CSAM and online grooming is the global average	Level of regulatory enforcement for CSAM and online grooming is low compared to the global average	Level of regulatory enforcement for CSAM and online grooming is low compared to the global average
Indicator 25: Legal Framework Against CSAM	There are major legislations specific to CSAM	There are some legislations specific to CSAM	There is no legislation specific to CSAM	There is no legislation specific to CSAM

Indicator 26: Legal Framework Against Online Grooming	There are legislations specific to online grooming (with or without the intent to meet the child)	There are legislations specific to online grooming (with or without the intent to meet the child)	There is no legislation specific to online grooming	There is no legislation specific to online grooming
Topic 9: Privacy & Safety Frameworks and Regulation	Level of regulatory enforcement for privacy and data protection is high, compared to the global average	Level of regulatory enforcement for privacy and data protection is above-par compared to the global average	Level of regulatory enforcement for privacy and data protection is below-par compared to the global average	Level of regulatory enforcement for privacy and data protection is low compared to the global average
Indicator 27: Privacy Frameworks and Regulation	Level of legislations specific to privacy regulations and data protection (e.g., e-Commerce legislation and data protection law) is high	Level of legislations specific to privacy regulations and data protection (e.g., e-Commerce legislation and data protection law) is above-par	Level of legislations specific to privacy regulations and data protection (e.g., e-Commerce legislation and data protection law) is below-par	Level of legislations specific to privacy regulations and data protection (e.g., e-Commerce legislation and data protection law) is low
Indicator 28: Child Data Processing	Level of legislations that require companies to seek parental approval using verifiable consent mechanisms is high	Level of legislations that require companies to seek parental approval using verifiable consent mechanisms is above-par	Level of legislations that require companies to seek parental approval using verifiable consent mechanisms is below-par	Level of legislations that require companies to seek parental approval using verifiable consent mechanisms is low
STAKEHOLDER 6: TECHNOLOGY INFRASTRUCTURE FOR CHILD ONLINE SAFETY				
Stakeholder 6: Technology Infrastructure for Child Online Safety	Level of technology infrastructure support for child online safety is high compared to the global average	Level of technology infrastructure support for child online safety is above-par compared to the global average	Level of technology infrastructure support for child online safety is below-par compared to the global average	Level of technology infrastructure support for child online safety is low compared to the global average
Topic 10: Universal Accessibility	Level of accessibility to internet and digital devices is high, compared to the global average	Level of accessibility to internet and digital devices is above-par the global average	Level of accessibility to internet and digital devices is below-par the global average	Level of accessibility to internet and digital devices is low, compared to the global average
Indicator 29: Internet Access	Level of Internet access in the nation is high	Level of Internet access in the nation is above-par	Level of Internet access in the nation is below-par	Level of Internet access in the nation is low
Indicator 30: Device Access	% of people own and use a mobile phone is over 96%	% of people own and use a mobile phone is between 68-96%	% of people own and use a mobile phone is below 68-96%	% of people own and use a mobile phone is below 68%
Indicator 31: Internet Affordability	Level of Internet affordability in the nation is high	Level of Internet affordability in the nation is above-par	Level of Internet affordability in the nation is below-par	Level of Internet affordability in the nation is low
Indicator 32: Internet Quality	Level of Internet quality in the nation is high	Level of Internet quality in the nation is above-par	Level of Internet quality in the nation is below-par	Level of Internet quality in the nation is low
Indicator 33: Network Coverage	Level of network coverage in the nation is high	Level of network coverage in the nation is above-par	Level of network coverage in the nation is below-par	Level of network coverage in the nation is low
Topic 11: Internet Access at Home & Schools	Level of access and connectivity to internet at home and school is high compared to the global average	Level of access and connectivity to internet at home and school is above-par compared to the global average	Level of access and connectivity to internet at home and school is below-par compared to the global average	Level of access and connectivity to internet at home and school is low compared to the global average
Indicator 34: Device Access – School	Level of device access at school is high compared to the global average	Level of device access at school is above-par compared to the global average	Level of device access at school is below-par compared to the global average	Level of device access at school is low compared to the global average

Indicator 35: Internet Access – School	Level of internet access at school is high compared to the global average	Level of internet access at school is above-par compared to the global average	Level of internet access at school is below-par compared to the global average	Level of internet access at school is low compared to the global average
Indicator 36: Device Access – Home	Level of device access at home is high compared to the global average	Level of device access at home is above-par compared to the global average	Level of device access at home is below-par compared to the global average	Level of device access at home is low compared to the global average
Indicator 37: Internet Access – Home	Level of internet access at home is high compared to the global average	Level of internet access at home is above-par compared to the global average	Level of internet access at home is below-par compared to the global average	Level of internet access at home is low compared to the global average
Topic 12: Cybersecurity Infrastructure	Level of cybersecurity infrastructure (legal, technical, organizational, capacity and cooperation) is high compared to the global average	Level of cybersecurity infrastructure (legal, technical, organizational, capacity and cooperation) is above-par compared to the global average	Level of cybersecurity infrastructure (legal, technical, organizational, capacity and cooperation) is below-par compared to the global average	Level of cybersecurity infrastructure (legal, technical, organizational, capacity and cooperation) is low compared to the global average
Indicator 38: Global Cybersecurity Index	Level of national cybersecurity commitment is high	Level of national cybersecurity commitment is above-par	Level of national cybersecurity commitment is below-par	Level of national cybersecurity commitment is low
Indicator 39: Secure Internet Servers	Level of secure internet servers is high compared to the global average	Level of secure internet servers is above-par compared to the global average	Level of secure internet servers is below-par compared to the global average	Level of secure internet servers is low compared to the global average

SCORING METHODOLOGY

The COSI score is calculated by successively combining the scores from each level of the hierarchy. The 6 Stakeholder scores combine the scores of 12 Topics, and the 12 topic scores combine the scores of 39 indicators.

At the lowest level, each indicator's score is standardized and calculated based on a weighted average of the sub-indicators within each indicator. Subsequently, these scores are transformed to fall within a range of 10 to 100, with 10 representing the lowest score and 100 indicating the highest attainable score.

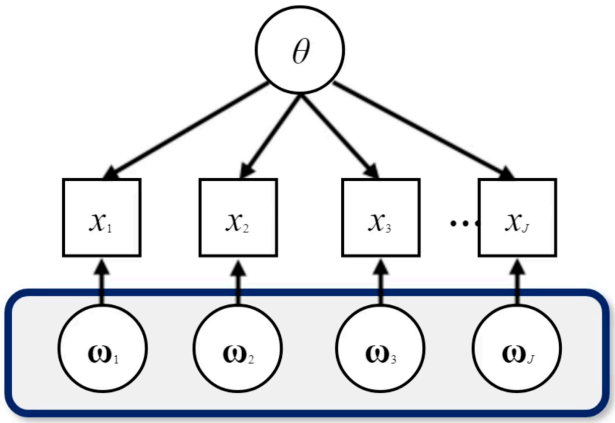
These individual indicator scores are then amalgamated to generate scores for each topic, and, subsequently, scores for each of the 6 stakeholders. The overall COSI score is subsequently computed as a weighted average of the 6 stakeholder scores, and reported as four-level performance level descriptors as mentioned above.

The development of the indicator scores involved four major steps, elaborated upon in the following section.

Step 1. Development of Individual Level Indicator Scores

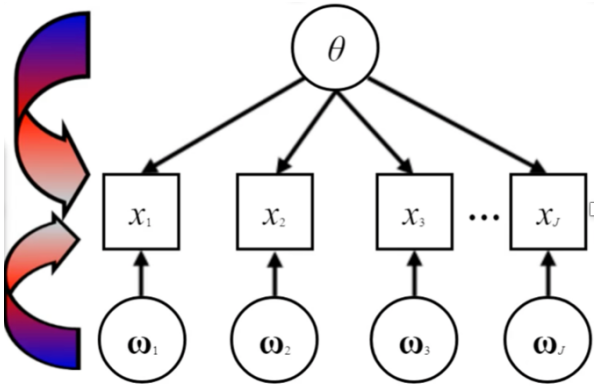
1.1 Reasoning through the Machinery of the Model

In probability models, reasoning through the machinery of the model amounts to deploying the calculus of probabilities. In DQ score, we use the following probability model:

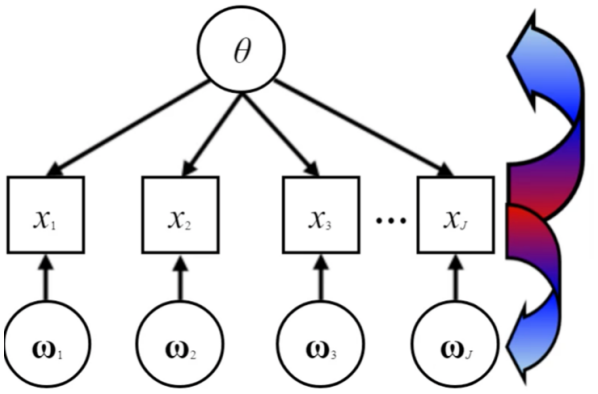


θ is the parameter for DQ score
x_j are observable variables summarizing learns performances on assessment j
ω_j are our model parameters such as estimated difficulty of assessment j or other parameters

The model is naturally set up in such a way that given the value of θ, and model parameters ω_j we have (conditional) distributions for the observables x_j as in the figure below, where the arrows express the flow of reasoning in our model.



This naturally supports probabilistic deductive reasoning from the former to the latter. However, we need to reason inductively to reverse the direction of the flow as shown below, where the arrows express the flow of reasoning in our model.



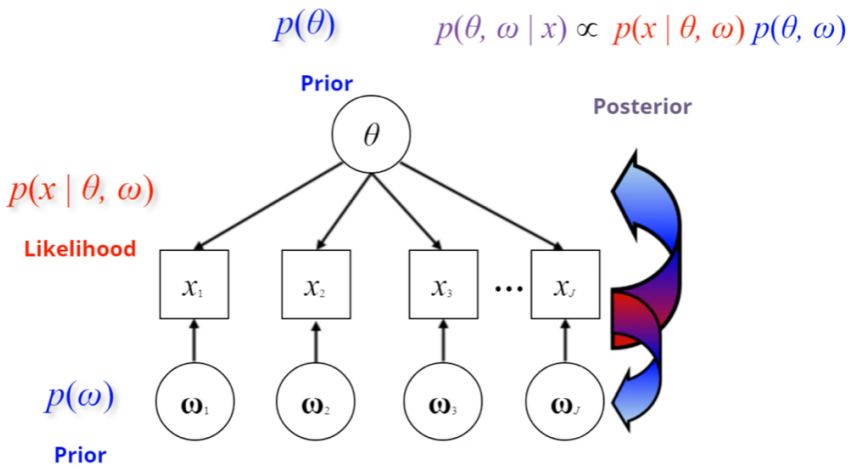
Thus,
Our goal: reason from $\mathbf{x_j}$ to make inferences about model parameters $\boldsymbol{\theta}$ and $\boldsymbol{\omega_j}$
Our strategy: set up model with a particular flow from $\boldsymbol{\theta}$ and $\boldsymbol{\omega_j}$ to $\mathbf{x_j}$
Our result: accomplish our goal by reversing the flow based on Bayes' theorem

Bayes' theorem

$$\mathbf{p(\theta|x)} = \frac{\mathbf{p(x|\theta)p(\theta)}}{\mathbf{p(x)}} \approx \mathbf{p(x|\theta)p(\theta)}$$

where,
$\boldsymbol{\theta}$—as above, a parameter (i.e., DQ score)
$\mathbf{p(x|\theta)}$—likelihood of parameter $\boldsymbol{\theta}$ given data $\mathbf{x}$
$\mathbf{p(\theta)}$—the prior distribution of $\boldsymbol{\theta}$
$\mathbf{p(\theta|x)}$—posterior distribution of $\boldsymbol{\theta}$ given $\mathbf{x}$

Therefore, to do the reversal means to obtain $\mathbf{p(\theta, \omega|x)}$ by synthesizing $\mathbf{p(x|\theta, \omega)}$ with the prior distribution $\mathbf{p(\theta)}$, where $\mathbf{p(x|\theta, \omega)} = \prod_{J=1}^{J} \mathbf{p(x_J\,|\theta, \omega_J)}$ captures the evidentiary value of our observations.



Via common exchangeability and conditional independence, Bayes' Theorem looks like the following:

$$p(\theta, \omega|x) \sim \prod \prod_{j=1}^{J} p(x_j|\theta, \omega_j) p(\theta) p(\omega_j)$$

Bringing commonly used probability distribution into Bayes' Theorem, we have

$$x_j|\theta\ \omega_j \sim \text{Bernouli}[\psi(\theta, \omega_j)]$$

where ψ is a cumulative logistic distribution.

$$\theta \sim N(\mu_0, \sigma_\theta^2)$$

where N is normal distribution with mean μ_0 and standard deviation σ_θ^2.

$$\omega_i \sim N^+(\mu_0, \sigma_\omega^2)$$

where N^+ is truncated at 0 normal distribution.

1.2 Propagating Uncertainty and Missing Data

Conventional approaches to modeling often proceed in stages in such a way that the uncertainty at one stage is ignored at later stages. For example, modeling and inference commonly proceed

by first obtaining estimates of parameters of some models, which are then treated as known for estimation. Using Bayesian allows us to incorporate and propagate uncertainty throughout all aspects of our modeling, including parameter estimation and the management of missing data x_J. The missing data, for example, can be viewed as a parameter and thus can be learned.

1.3 Accumulation of Evidence

Importantly, Bayesian theorem allows us to accumulate evidence. The posterior distribution is a synthesis of the prior and the data. With little data x_J, the solution is more heavily influenced by the prior and less so by the data. As more data arrive, they swamp the prior such that the solution becomes increasingly like what the data alone dictate.

As a result, analysts with different prior beliefs (and prior distributions) may have very different conclusions if there is no or little data. When more data are increasingly incorporated, conclusions converge, and posterior distributions resemble each other. A related point concerns the accumulation of evidence as data arrive.

Let x_1 and x_2 be data from two tests. Let these data be independent, given DQ score θ.

$$p(\theta|x_1, x_2) \sim p(x_1, x_2|\theta)p(\theta) =$$

using factorization of the conditional probability of the test x_1 and x_2 data

$$= p(x_2|\theta, x_1)p(x_1|\theta)p(\theta) =$$

using an assumption that scores of test x_1 and test x_2 are independent given the value θ of DQ score

$$= p(x_2|\theta)p(x_1|\theta)p(\theta) \sim$$

using Bayes' theorem

$$\sim p(x_2|\theta,)\ p(\theta|x_1)/p(\theta)]p(\theta)$$

$$= p(x_2|\theta)p(\theta|x_1)$$

Where $p(x_2|\theta)$ is the conditional probability of the (new) data.
$p(\theta|x_1)$ is the prior distribution for the value θ of DQ score (prior to having observed x_2).
It could also be looked at as the posterior distribution for value θ of DQ score given x_1.

Thus, the equation above shows that we begin with a prior distribution for the unknowns, $p(\theta)$ and by incorporating the first dataset we have the posterior distribution $p(\theta|x_1)$, which in turn serves as the prior distribution when incorporating the second dataset, x_2. At any point, our "current" distribution is both a posterior distribution and a prior distribution: it is posterior to the past data and prior to future data—today's posterior is just tomorrow's prior.

1.4 Conceptual Simplicity and Missing Data

A fully Bayesian analysis offers considerable simplicity for how to proceed: if θ is unknown it gets a prior distribution, and once we condition on what we do know, we have a posterior distribution. More broadly, terminological variations for conveying distinctions among the roles that a latent variable, parameter, or missing data point may play, a fully Bayesian analysis offers considerable simplicity for how to proceed. This conceptual simplicity translates to technical matters. Indeed, estimating posterior distributions remains the same regardless of what we call θ, and in Markov chain Monte Carlo (MCMC) strategies, obtaining a posterior distribution for unknown x, often referred to as missing data, is the same as for unknown θ regardless of what we call it.

1.5 Linking Methodology

Furthermore, as we have used the two different assessment tools: DQ World and DQ Assessment API, we have used the following linking statistical moderation technique to establish a link between different assessments used in indicator scores. In this approach, assessment I results are expressed in the metric of assessment J.

Definition: A score on the assessment I and a score on the assessment J are equivalent in a group of test takers (I and J are linked), if they represent the same relative position in the group.

We can rewrite this definition with an adjustment that defines "relative position" in terms of the mean and the standard deviation. For example, a score on I and a score on J are equivalent in a group of test takers, if they are the same number of standard deviations above or below the mean of the group.

Therefore, the definition can be written as simple mathematical formulas:

$$\frac{I - \text{mean}(I)}{SD(I)} = \frac{J - \text{mean}(J)}{SD(J)}$$

Solving this equation for J gives us a formula for linking I and J:

$$J = \left(\frac{SD(J)}{SD(I)}\right) I + \left[\text{mean}(J) - \left(\frac{SD(J)}{SD(J)}\right) \text{mean}(I)\right] = \text{adjusted I}$$

The adjusted scores on I have the same mean and the standard deviation as the raw scores on J. That is what it means in statistical moderation to say, "Test I is linked to test J."

Since the means and the standard deviations for I and J are constants, the linking adjustment consists simply of multiplying the test taker's score on I by one number and adding another number.

Step 2: Development of National Level Indicator Scores

The national-level scores for sub-indicators are developed based on the calculated DQ scores of individuals. Moreover, we have aggregated other national-level sub-indicators that have been developed from various external data sources. To develop the indicator scores from these sub-indicators collected from various sources, we have used the following standardization methodology:

1. Scaling each sub-indicators into the scale of 0 to 1, using a scaling formula of (the observed value – the minimum value) / (the maximum value – the minimum value)
2. Missing data imputation
3. Normalization of sub-indicators, using a normalization formular of (the scaled value – mean value of the sub-indicator) / standard deviation value of the sub-indicator
4. Scaling to the scale of 10 to 100

Step 3: Missing Data Imputation

COSI includes the indicators from multiple internal and external data sources from year 2017 to 2023. Before the normalization of the indicators, the missing country data have been estimated following the two processes below:

1. When some data of a particular country from a particular year are missing (and those of the other years are present), we impute the missing data by the principles of Last Observation Carried Forward (LOCF) and Next Observation Carried Backward (NOCB).
2. For those missing values of country data on the sub-indicator(s), the multiple logistic regression prediction models are used when strong predictors in other indicator values are available with greater than 0.3 R square value. In the absence of such values, a 25-percentile value of the corresponding sub-indicator is imputed.

Step 4: Calibration and Adjustment

Due to convenience sampling, the number of participants is not equal across the age groups. Thus, we check for statistically significant differences between the age groups and across four data sources. When statistically significant differences are found, we calculate the measures separately and develop a weighted average based on the sampling size as well as the geographic representation of the data sources.

DATA

DQ Institute has been serving as a knowledge hub that develops a global databank for aggregated data related to child online safety and digital citizenship education. The DQ databank combines national-level data from external sources with individual-level data from DQ Impact Tracker that is linked to two different mediums—the online platform DQ World and the DQ Assessment API System.

DATA COLLECTION

DQ Impact Tracker

The DQ Impact Tracker is an assessment tool that is deployed through two programs—the DQ World and the DQ Assessment API system.

DQ World is the main platform to collect children's data. As children participants engage in various "missions" on the platform, they complete surveys and quizzes that reinforce interactive activities. Each child's responses are tracked to measure progress, assess risk, and generate data. Children participants are asked to answer self-reporting survey questions related to social emotional abilities and responsible cyber attitudes/behaviors. They are also tested on technical and critical reasoning abilities through various interactive activities and quizzes.

The DQ Assessment API System provides customized survey questions based on the programs of the DQ World and of other partner organizations. All the questions from the DQ Assessment API System are then matched with those from the DQ World.

Children participants are recruited with the aid of teachers and school administrators who are contacted by our partner organizations in each country. Participation is done either in the classroom or at home, through the DQ World platform. In some countries, paper surveys are used, and the results are coded and shared by the teachers.

The entire participation process is online. However, there are three procedures that need to be completed prior to initiating online participation.

1. Invitation to schools: Interested schools are invited for a briefing session where DQ Institute shares the aims of the study, implementation guidelines, and the role of teachers and key personnel involved.

2. Teachers' briefing and registration: Teachers from the participating schools are informed about the online learning experience and the proposed research aims. The teachers are guided to help with the registration of participating children on the relevant online platform(s).

3. Parental opt-out option: An opt out form is made available to parents to provide an option to opt their children out of the study.

Sample Size

Through the DQ Impact Tracker, data of a total of 351,376 children and adolescents (aged 8-18) across 100 countries have been collected from March 2017 to September 2023.

COUNTRIES	SAMPLE SIZE
Thailand	83,839
Japan	43,074
Australia	38,179
Indonesia	28,900
Philippines	26,607
Turkey	22,884
Mexico	18,013
Singapore	16,847
Spain	7,468
Colombia	7,266
United States of America	5,981
China	5,967
New Zealand	5,461
Republic of Korea	4,761
Peru	4,361
Ecuador	3,596
Nigeria	3,412
Viet Nam	3,190
India	2,456
South Africa	2,057
Italy	1,862
Dominican Republic	1,789
Nepal	1,529
Malaysia	1,166
United Kingdom of Great Britain and Northern Ireland	1,127
Saudi Arabia	1,043
Other countries	8,586
Total	**351,376**

LIMITATIONS

This study has been conducted as part of the #DQEveryChild initiative, and the participants of the #DQEveryChild initiative have served as a convenience sample for this study. The number of participants from each country thus varies depending on the extent of the initiative's adoption in the given country, and the sample may not be representative of all children within the country. This is particularly true for countries with a high level of participation from elite private schools in the #DQEveryChild initiative.

EXTERNAL DATA SOURCES

SUB-INDICATORS	SOURCE REPORT	SOURCE PUBLICATION YEAR	ORGANIZATION
Gender parity index for youth/adults with information and communications technology (ICT) skills (Connecting and installing new devices (e.g., modem, camera, printer))	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Creating electronic presentations with presentation software (including images, sound, video, or charts))	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Finding, downloading, installing, and configuring software)	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Sending e-mails with attached files (e.g., document, picture, video))	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Transferring files between a computer and other devices)	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Using basic arithmetic formulas in a spreadsheet)	SDG Tracker	2016 - 2022	Global Change Data Lab

Gender parity index for youth/adults with information and communications technology (ICT) skills (Using copy and paste tools to duplicate or move information within a document)	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity index for youth/adults with information and communications technology (ICT) skills (Writing a computer program using a specialized programming language)	SDG Tracker	2016 - 2022	Global Change Data Lab
Gender parity of employed ICT specialists (Broad definition based on the ISCO-08 classification and including jobs) (%)	Women in Digital (WID)	2021	EU Commission
Trust in government websites and apps (To what extent do you trust the information you receive from the following sources online?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Trust in online privacy (To what extent do you feel confident that your activity online is private?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Trust in non-government websites and apps (To what extent do you trust the information you receive from the following sources online?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Trust in information from social media (To what extent do you trust the information you receive from the following sources online?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Trust in e-Commerce safety (To what extent do you think safe and secure to make purchases online?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Law for ISPs to block illegal content (sexual abuse and exploitation)	Out of the Shadows	2020, 2022	Economist Intelligence Unit
Law for ISPs to report illegal content (sexual abuse and exploitation)	Out of the Shadows	2020, 2022	Economist Intelligence Unit
Law for ISPs: mandatory content blocking and deleting of child pornography	Out of the Shadows	2020, 2022	Economist Intelligence Unit
Law for ISPs: mandatory record keeping of illegal content (sexual abuse and exploitation)	Out of the Shadows	2020, 2022	Economist Intelligence Unit
Legislation specific to online grooming: intent to meet the child	Out of the Shadows	2020, 2022	Economist Intelligence Unit
Legislation specific to online grooming: regardless of intent to meet the child	Out of the Shadows	2020, 2022	Economist Intelligence Unit

Failure to report	Out of the Shadows	2022	Economist Intelligence Unit
Cooperation	Out of the Shadows	2022	Economist Intelligence Unit
Providers of electronic communication services	Out of the Shadows	2022	Economist Intelligence Unit
Child data processing	Out of the Shadows	2022	Economist Intelligence Unit
Privacy regulations (Does the country have data protection law(s) and legal or financial penalties in place for firms that do not follow the law?)	Inclusive Internet Index	2022	Economist Intelligence Unit
Privacy protection by law content	Network Readiness Index	2020, 2022	Portulans Institute and World Information Technology and Services Alliance (WITSA)
e-Commerce legislation (whether a country has adopted legislation or has a draft law pending adoption in four areas: electronic transactions, consumer protection, privacy and data protection, and cybercrime.)	Network Readiness Index	2020, 2022	Portulans Institute and World Information Technology and Services Alliance (WITSA)
Gender parity of youth not in education, employment, or training	SDG Tracker	2016 - 2022	Global Change Data Lab
Mobile cellular subscriptions (per 100 inhabitants)	Inclusive Internet Index	2022	Economist Intelligence Unit
Mobile broadband subscriptions (per 100 of the population)	Country ICT Data	1960 - 2022	International Telecommunication Union
Fixed broadband subscriptions (per 100 inhabitants)	Country ICT Data	1960 - 2022	International Telecommunication Union
Percentage of the population covered by a mobile-cellular network	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage of the population covered by at least a 3G mobile network	Inclusive Internet Index	2022	Economist Intelligence Unit

Percentage of the population covered by at least an LTE/WiMAX mobile network	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage of the population covered by a 5G mobile network	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage of the population covered by at least a 2G mobile network	SDG Tracker	2016 - 2022	Global Change Data Lab
Proportion of individuals using a mobile phone	Country ICT Data	1960 - 2022	International Telecommunication Union
Proportion of individuals who own a mobile telephone	SDG Tracker	2016 - 2022	Global Change Data Lab
Internet Affordability: Price	Inclusive Internet Index	2021	Economist Intelligence Unit
Internet Affordability: Competitive environment	Inclusive Internet Index	2021	Economist Intelligence Unit
Fixed broadband upload speed (Mbps)	Inclusive Internet Index	2022	Economist Intelligence Unit
Fixed broadband download speed (Mbps)	Inclusive Internet Index	2022	Economist Intelligence Unit
Fixed broadband latency	Inclusive Internet Index	2022	Economist Intelligence Unit
Mobile upload speed (Mbps)	Inclusive Internet Index	2022	Economist Intelligence Unit
Mobile download speed (Mbps)	Inclusive Internet Index	2022	Economist Intelligence Unit
Mobile latency	Inclusive Internet Index	2022	Economist Intelligence Unit
Bandwidth capacity	Inclusive Internet Index	2022	Economist Intelligence Unit
Internet exchange points	Inclusive Internet Index	2022	Economist Intelligence Unit
Proportion of lower secondary schools with access to the internet for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab
Proportion of primary schools with access to the internet for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab

Proportion of upper secondary schools with access to the internet for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab
Proportion of lower secondary schools with access to computers for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab
Proportion of primary schools with access to computers for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab
Proportion of upper secondary schools with access to computers for pedagogical purposes	SDG Tracker	2016 - 2022	Global Change Data Lab
Percentage difference between male and female access to the Internet	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage difference between male and female access to mobile phones	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage difference in access between males and females	Inclusive Internet Index	2022	Economist Intelligence Unit
Percentage difference in the Internet usage between male and female	Network Readiness Index	2020, 2022	Portulans Institute and World Information Technology and Services Alliance (WITSA)
Level of country's commitment to cybersecurity	Network Readiness Index	2020, 2022	Portulans Institute and World Information Technology and Services Alliance (WITSA)
Secure Internet servers using encryption technology in Internet transactions (per million population)	International Digital Economy and Society (DESI) Index 2020	2015 - 2018	EU Commission
Secure Internet servers using encryption technology in Internet transactions (per million population)	Network Readiness Index	2020, 2022	Portulans Institute and World Information Technology and Services Alliance (WITSA)

REFERENCES

Anders, D. (2019). What is a Good Internet Speed? Retrieved from https://www.allconnect.com/blog/internet-speed-classifications-what-is-fast-internet.

Anderson, C. A., Berkowitz, L., Donnerstein, E., Huesmann, L. R., Johnson, J. D., Linz, D., Malamuth, N. M., & Wartella, E. (2003). The influence of media violence on youth. Psychological Science in the Public Interest, 4(3), 81–110. https://doi.org/10.1111/j.1529-1006.2003.pspi_1433.x.

Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., Rothstein, H. R., & Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review. Psychological Bulletin 136(2): 151–173. https://doi.org/10.1037/a0018251.

Anderson, C., Gentile, D., & Buckley, K. (2007). Violent video game effects on children and adolescents: Theory, research, and public policy. Oxford University Press.

Ang, R., & Goh, D. (2010). Cyberbullying among adolescents: The role of affective and cognitive empathy, and gender. Child Psychiatry & Human Development, 41, 387-397. https://doi.org/10.1007/s10578-010-0176-3.

Broadband Commission for Sustainable Development (2019). Child online safety: Minimizing the risk of violence, abuse, and exploitation online. Retrieved from: https://www.broadbandcommission.org/Documents/working-groups/ChildOnlineSafety_report.pdf.

Busching, R., Gentile, D. A., Krahé, B., Möller, I., Khoo, A., Walsh, D. A., & Anderson, C. A. (2015). Testing the reliability and validity of different measures of violent video game use in the USA, Singapore, and Germany. Psychology of Popular Media Culture, 4, 97-111.

DQ Institute (2018). DQ Impact Report. Retrieved from: https://www.dqinstitute.org/wp-content/uploads/2018/08/2018-DQ-Impact-Report.pdf.

Dutta, S., & Lanvin, B. eds. (2020). Network Readiness Index: Accelerating Digital Transformation in a post-COVID Global Economy. Portulans Institute and World Information Technology and Services Alliance. Retrieved from: https://networkreadinessindex.org/wp-content/uploads/2022/09/NRI_2020_Report.pdf.

Dutta, S., & Lanvin, B. eds. (2022). Network Readiness Index: Stepping into the new digital era. Portulans Institute and World Information Technology and Services Alliance. Retrieved from: https://networkreadinessindex.org/nri-2022-edition-press-release/.

Economist Intelligence Unit (2019). Out of the Shadows: Shining light on the response to child sexual abuse exploitation: A 40-Country Benchmarking Index. Retrieved from: https://outoftheshadows.eiu.com/.

Economist Intelligence Unit (2020). Out of the Shadows Index: Shining light on the response to child sexual abuse exploitation: A 60-Country Benchmarking Index. Retrieved from: https://outoftheshadows.eiu.com/.

Economist Intelligence Unit (2023). The Inclusive Internet Index. Retrieved from: https://impact.economist.com/projects/inclusive-internet-index/2022.

Economist Intelligence Unit (2022). Out of the Shadows: Index 2022. Retrieved from: https://outoftheshadows.global/.

European Commission (2020). Women in Digital Scoreboard. Retrieved from: https://digital-strategy.ec.europa.eu/en/library/women-digital-scoreboard-2020.

European Commission (2015-2022). International Digital Economy and Society Index (DESI). Retrieved from: https://digital-strategy.ec.europa.eu/en/library.

Gentile, D. A., Bailey, K., Bavelier, D., Funk, J. B., Cash, H., Doan, A., Grant, D. S., Green, C. S., Griffiths, M. D., Markle, T., Petry, N. M., Prot, S., Rae, C. D., Rehbein, F., Rich, M., Sullivan, D., Woolley, E., & Young, K. (2017). Internet Gaming Disorder in children and adolescents. Pediatrics, 140, S81–S85.

Gentile, D. A., Lynch, P. J., Linder, J. R., & Walsh, D. A. (2004). The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance. Journal of Adolescence, 27(1), 5-22.

Global Change Data Lab (2000-2023). Sustainable Development Goal Tracker: Measuring Progress towards the Sustainable Development Goals. Retrieved from: https://ourworldindata.org.

Global System for Mobile Communications (2019). GSMA Mobile Connectivity Index. Retrieved from http://www.mobileconnectivityindex.com/#year=2018&secondaryMenu=about-the-index.

International Centre for Missing & Exploited Children (2018). Child Sexual Abuse Material: Model Legislation & Global Review. Retrieved from: https://www.icmec.org/child-pornography-model-legislation-report/.

International Telecommunication Union (2010-2022). Statistics and Indicators: Country ICT Data. Retrieved from: https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

International Telecommunication Union (2019). ITU Committed to connecting the world. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

International Telecommunication Union (2018). Global Cybersecurity Index. Retrieved from: https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx.

Lemmens, J., Valkenberg, P., & Gentile, D. (2015). The Internet Gaming Disorder Scale. Psychological Assessment, 27(2), 567.

Livingstone, S., & Bober, M. (2004). Taking up online opportunities? Children's uses of the Internet for education, communication, and participation. E-Learning and Digital Media, 1(3), 395-419.

Livingstone, S., & Haddon, L. (2009). EU Kids Online. Zeitschrift Für Psychologie/Journal of Psychology, 217(4), 236.

Patchin, J. (2019). Summary of Our Cyberbullying Research (2007-2019). Cyberbullying Research Center. Retrieved from: https://cyberbullying.org/summary-of-our-cyberbullying-research.

Speedtest (2019). Internet speed glossary. Retrieved from: https://www.speedtest.net/about/knowledge/glossary.

Speedtest (2023). Speedtest Global Index. Retrieved from: https://www.speedtest.net/global-index.

van den Eijnden, R. J. J. M., Lemmens, J. S., & Valkenburg, P. M. (2016). The Social Media Disorder Scale. Computers in Human Behavior, 61, 478–487. https://doi.org/10.1016/j.chb.2016.03.038.