Metadata on the Indicators of the Edtech Readiness Index (ETRI)
March 2023

The document *Metadata on the Indicators of the Edtech Readiness Index (ETRI)* was elaborated by the World Bank's Education Global Practice as part of the EdTech Readiness Index. Version 1.0. Published on 22nd of March 2023. For further information please contact: ETRI@worldbank.org.

Table of Contents

1. School Management

Indicator – School Management Practices

Type of indicator
Pillar: School Management
Level: Practices
Questionnaire: School Survey (SS)
Respondent: Principal

Definition
The *School Management Practices* indicator assesses the readiness of the school management to use and promote the use of ICT in education. The indicator tracks three aspects: 1) the existence of an ICT strategy, 2) the presence of leadership practices to ensure a broader set of stakeholders are part of the ICT strategy, and 3) the prioritization of ICT as it relates to student outcomes.

Background & Rationale
Within school management at the school level, the evidence points at the integration of ICT in the school's vision and strategic plans as a key element to fostering the implementation and use of digital technologies in school (Fullan, 2012; Law, Pelgrum, & Plomp, 2008).
Furthermore, Wu, Yu, & Hu (2019) have shown that respondents' e-leadership has a positive effect in the use and integration of digital technologies in teaching and learning. E-leadership refers to approaches and practices that aim to realize the vision and goals for e-learning (Chen, Ho, & Ng, 2013). Studies have shown that schools with clear and consistent e-leadership that provide stronger levels of technology support, teachers are more prepared to integrate the use of ICT in their teaching activities (Olszewski & Crompton, 2020; Wu, et al., 2019).
Kennisnet (2015) emphases that, at the school level, a balance of 4 elements is needed for improving educational outcomes through ICT. Leadership and guidance is one of them; It means that the role of ICT in the schools' strategic plans and the leadership of the school management team to encourage and support the use of ICT, is necessary, but more effective if the three other elements (availability of devices and infrastructure, adequate content available and the teachers' ICT skills) are in place too.

Questions used for data collection

School survey:
B12. To what extent do you agree or disagree with the following statements about the use of ICT at your school?
(1. Strongly disagree, 2. Disagree, 3. Agree, 4. Strongly agree)
a. In my school, there is a digital strategy or a plan/strategy to incorporate the use of technology and/or devices into the teaching and administration of the school.
b. In my school, the school leaders involve teachers in the development of the school's digital strategy.
c. In my school, school leaders support teachers in trying out new ways of teaching with ICT.
d. In my school, there are discussions on the advantages and disadvantages of teaching and learning with ICT.

B13. In your school, how important is it to ensure students have the skills to use ICT in each of the following ways?
(1. Not Important; 2. A little important; 3. Moderately important; 4. Very important)
a. For basic computer functions (e.g. Internet use, email, word processing, presentation software).
b. For accessing and using information.
c. For using digital devices safely and appropriately.
d. For improving their learning in non-ICT topics

Method of calculation and scores

The indicator is calculated based on information collected through the school survey (SS). Through 2 questions, comprising a total of 8 factors, respondents are asked to indicate the level of agreement with key statements (4

factors) and to indicate the relative level of importance of 4 types of outcomes (4 factors). All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	Agreement	Importance
1	Strongly Disagree	Not important
2.33	Disagree	A little
3.67	Agree	Moderately
5	Strongly Agree	Very

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate score reported is the average weighted score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Strategy	B12 a	Agreement	NA
	Leadership	B12 b-c-d	Agreement	Average
	Prioritization	B13 a-b-c-d	Importance	Average
Indicator	School management practice	Strategy: Leadership; Prioritization	N/A	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the school-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	Statistics
Strategy	- Percentage of respondents who agree yes there is an ICT strategy in their school (Agree or strongly agree)
Leadership	- Percentage of respondents who agree that school leaders support teachers in trying out new ways of teaching with digital technologies (Agree or strongly agree) - Percentage of respondents who agree that there are discussions on the advantages and disadvantages of teaching and learning with digital technologies (Agree or strongly agree)
Prioritization	- Percentage of respondents who give importance to the development of students' basic computer skills (A little, moderately, very important) - Percentage of respondents who give importance to the development of students' proficiency in accessing and using information with ICT (A little, moderately, very important) - Percentage of respondents who give importance to the development of students' understanding and skills relating to safe and appropriate use of ICT (A little, moderately, very important) - Percentage of respondents who give importance to the use of ICT to augment and improve students' learning (A little, moderately, very important)

Indicator – School Management De Facto Policies

Type of indicator

Pillar: School Management
Level: De Facto Policies
Questionnaire: School Survey
Respondent: Principal

Definition

The *School Management De Facto Policies* indicators assesses the respondents' awareness of the school management to use and promote the use of ICT in education. The indicator tracks three aspects: 1) the responsibility assigned for the integration of the use of ICT if there is an ICT strategy, 2) the presence of guidance for incorporating ICT into teaching and learning, and 3) the support through training.

Background & Rationale

Vinnet and Pont (2017) list four dimensions to consider when implementing educational policies and two of them are policy design and having a coherent implementation strategy to reach schools. A good policy design includes information on the logic between the policy problem and the solution it offers, as well as the feasibility (whether and how a policy should be implemented). An implementation strategy, meaning an operational plan that guides the process, includes, among others, clear task allocation and accountability mechanisms and policy tools. The strategy should outline concrete measures that bring all the determinants together in a coherent manner to make the policy operational at the school level.

Evidence show that when appropriate teacher training and professional development are provided students' learning can be improved (Archer, et al., 2014; Bernard, et al., 2018; Chauhan, 2017). Complementary, from a more general perspective, the review of education interventions by Evans and Popova (2015) shows that teacher training interventions can be more effective if they are tailored to teacher involved, particularly to students skills.

One of the seven dimensions of the European Commission framework to guide educational institutions in their adoption of digital technologies is related to professional development (Kampylis, Punie, & Devine, 2015). They note that the availability of continuous, comprehensive and customized professional development of its staff at all levels in order to develop and integrate new modes of teaching and learning that harness digital learning technologies is necessary to achieve more comprehensive learning outcomes.

Questions used for data collection

School survey:

B14. Which level of the education system is mainly responsible for integrating ICT use into schools' strategic plans?
a. National level
b. Sub-national/local level
c. School level
c. No level; those responsibilities are not assigned
d. I don't know

B15. Does your school use guidelines or supporting tools provided by the national or sub-national educational authorities on incorporating ICT into teaching and learning activities?
a. Yes, and they are useful
b. Yes, but they are not very useful for what my school needs.
c. No, the educational authorities do not provide these guidelines.
d. I don't know about the existence of these guidelines/tools.

B16. Over the last 12 months, did you attend or participate in any training on the management and use of ICT teaching and learning?

a. Yes. In official training that was required by government.
b. Yes. In official training with optional attendance.
c. Yes. In unofficial training (e.g. meetings and workshops) with other principals/teachers where such practices were shared.
d. No.

Method of calculation and score

The indicator is calculated based on information collected through the school survey (SS). Through 3 questions, with each a choice of 4 answers based on respondents' awareness about the existence of certain ICT legal aspects. All answers have an equal weight and are scored as indicated below.

Each answer is scored as follows:

Score	Allocation of responsibility	Guidelines/usefulness	Training
1	No	None	None
1	I don't know	I don't know	
2.5		Yes, not useful	Yes, in unofficial training OR official training with optional attendance
5	Yes (National, sub-national/local or school)	Yes, useful	Yes, in official training that was required

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	**Name**	**Input**	**Answer scores**	**Calculation**
Sub-indicators	Responsibility	B14	Allocation of responsibility	NA
	Guidance	B15	Guidelines/usefulness	NA
	Support	B16	Training	NA
Indicator	School management *de facto* policies	Responsibility: Guidance; Support	N/A	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the school-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	**Statistics**
Responsibility	- Percentage of school respondents who are aware of the legal allocation of responsibility for the integration of ICT in schools' strategic plan
Guidance	- Percentage of school respondents who are aware of guidance for incorporating ICT in teaching and learning. If Yes, level of usefulness
Support	- Percentage of school respondents who participated in training on ICT for teaching and learning. If Yes, formally required or not

Indicator – School Management De Jure Policies

Type of indicator

Pillar: School Management
Level: De Jure Policies
Questionnaire: Policy Survey
Respondent: Policy/Education expert

Definition

The *School Management De Jure Policies* indicator assesses the existence of the school management to use and promote the use of ICT in education. The indicator tracks three aspects: 1) the responsibility assigned for the integration of the use of ICT if there is an ICT strategy, 2) the presence of guidance for incorporating ICT into teaching and learning, and 3) the support through training.

Background & Rationale

Vinnet and Pont (2017) list four dimensions to consider when implementing educational policies and two of them are policy design and having a coherent implementation strategy to reach schools. A good policy design includes information on the logic between the policy problem and the solution it offers, as well as the feasibility (whether and how a policy should be implemented). An implementation strategy, meaning an operational plan that guides the process, includes, among others, clear task allocation and accountability mechanisms and policy tools. The strategy should outline concrete measures that bring all the determinants together in a coherent manner to make the policy operational at the school level.

Evidence shows that when appropriate teacher training and professional development are provided students' learning can be improved (Archer, et al., 2014; Bernard, et al., 2018; Chauhan, 2017). Complementary, from a more general perspective, the review of education interventions by Evans and Popova (2015) shows that teacher training interventions can be more effective if they are tailored to teacher involved, particularly to students skills.

One of the seven dimensions of the European Commission framework to guide educational institutions in their adoption of digital technologies is related to professional development (Kampylis, Punie, & Devine, 2015). They note that the availability of continuous, comprehensive and customized professional development of its staff at all levels in order to develop and integrate new modes of teaching and learning that harness digital learning technologies is necessary to achieve more comprehensive learning outcomes.

Questions used for data collection

Policy survey:

B7. Is there legislation and/or policies governing schools that assign responsibility for integrating ICT use into schools' strategic plans?
1. Yes, those responsibilities are assigned mainly to the national level.
2. Yes, those responsibilities are assigned mainly to the sub-national levels.
3. Yes, those responsibilities are assigned mainly to the local levels.
4. Yes, those responsibilities are assigned to the school level.
5. Responsibilities are not explicitly assigned in the legislation and/or policies.

B8. Does your country provide schools with guidelines or supporting tools to incorporate ICT into teaching and learning activities?
0 = No
1 = Yes

B10. Are the principals of public schools required to complete training on the management and use of ICTs for teaching and learning as part of their continuing professional development?
0 = No
1 = Yes

Method of calculation and score

The indicator is calculated based on information collected through the policies survey (PS). Through 3 questions, with each a choice of 2 answers (or merge into 2) based the existence of certain ICT legal aspects. All answers have an equal weight and are scored the same way.

Each answer is scored as follows:

Score	Allocation of responsibility	Guidance /Training
1	No	No
2.5		
5	Yes (National, sub-national/local or school)	Yes
1	I don't know	I don't know

The average score across selected factors is calculated to get a system-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Responsibility	B7	Allocation of responsibility	NA
	Guidance	B8	Guidance (yes no)	NA
	Support	B10	Training (yes-no)	NA
Indicator	School management *de jure* policies	Responsibility; Guidance; Support	NA	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the policy-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	Statistics
Responsibility	- The existence of a legal allocation of responsibilities for integrating the use of ICT in school's strategic plans. If yes, at what level
Guidance	- The existence of guidelines or supporting tools for incorporating ICT into teaching and learning activities
Support	- The existence of support for principal through training on ICT for teaching and learning activities

2. Teachers

Indicator – Teacher Practices

Type of indicator
Pillar: Teachers
Level: Practices
Questionnaire: School Survey
Respondent: Principal or Teacher

Definition
The *Teacher Practices* indicator assesses the readiness of grade X teachers to integrate ICT in their class instruction. The indicator tracks three aspects: 1) teacher's efficacy, 2) use of technology for lesson preparation, and 3) use of technology for teaching and assessment.

Background & Rationale
In relation to the use of digital technologies by teachers, three areas are commonly identified: the use of ICT for professional engagement (collaboration, educational management and professional development), integration of digital tools in their pedagogies (planning and preparation, teaching and learning and learning assessment) and strategies to teach digital competences to the students.
In relation to the practices at the school level, one of the key elements considered in the literature is the teachers' competences and skills (and the strategies to develop them, such as teacher professional development initiatives and incentives).
From the school perspective, the key factors associated to the use of ICT in the classroom are teachers' perception of their ability to use ICT for teaching, self-efficacy practice (Law, et al., 2008; Lawrence & Tar, 2018), availability of appropriate software, and the extent of collaboration among teachers (Fraillon, Ainley, Schulz, Friedman, et al., 2019; Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017).

Questions used for data collection

School survey:
C19. Considering **the last 3 months**, to what extent did the grade X teacher do the following activities at any time during his/her direct class instruction?
(1. Never or hardly ever; 2. In some lessons; 3. In most lessons; 4. In every lesson; 9. I don't know)
a. Use ICT to search for information during in-class discussions.
b. Use ICT to present information (e.g. text, images, videos) during class instruction.
c. Use classroom management tools (e.g. Google classroom, Microsoft Teams).
d. Ask students to search for information (content) on the Internet.
e. Ask students to present results or outputs using digital tools.
f. Use digital tools to assess students' learning (e.g. tests, quizzes, etc.).

C20. **During the last 3 months**, to what extent did the grade X teacher do the following activities using digital devices (e.g. computer, tablet, smartphone, etc.) while preparing or planning his/her lessons?
(1. Never or hardly ever; 2. Once or twice a month; 3. Once or twice a week; 4. Every day or almost every day; 9. I don't know)
a. Search for lesson/educational content to use in the classroom (resources on the Internet, on education portals, etc.).
b. Share educational content with other teachers.
c. Participate in a project developed with other teachers and educators.
d. Prepare presentations or other educational materials to use for teaching.
e. Develop or deepen knowledge about the use of teaching and learning technologies.
f. Administrative class management (e.g. recording absenteeism, producing grade reports, etc.).

SS C21. How confident are you that grade X teacher can perform the following tasks using ICT?
(1. Not confident at all; 2. A little confident; 3. Moderately confident; 4. Very confident; 9. I don't know)
a. Contribute to a discussion forum or user group on the Internet (e.g. a wiki or blog).
b. Produce presentations (e.g. using Microsoft PowerPoint or a similar program) to use during class.
c. Prepare lessons that involve the use of ICT by students.
d. Use a spreadsheet program (e.g. Microsoft Excel) for keeping records or working with data.
e. Assess student learning using ICT.
f. Collaborate with colleagues using shared resources (e.g. Google Docs, OneNote).

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 18 factors, respondents are asked to indicate the level of frequency of key activities (12 factors) and to indicate the relative confidence on performance of 6 tasks (6 factors). All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	Frequency (lessons)	Frequency (time)	Confidence
1	Never or hardly ever	Never or hardly ever	Not confident at all
2.33	In some lessons	Once or twice a month	A little confident
3.67	In most lessons	Once or twice a week	Moderately confident
5	In every or almost every lesson	Every day or almost every day	Very confident

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Use - Teaching	C19 a–f	Frequency (lessons)	Average
	Use - Planning	C20 a–f	Frequency (time)	Average
	Self-efficacy	C21 a–f	Confidence	Average
Indicator	Teacher practices	Responsibility; Guidance; Support	NA	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the policy-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	Statistics
Use - Teaching	- Percentage of respondents who are aware that grade X teachers use digital devices to perform teaching activities (6 in total) (some lessons or more)

	- Percentage of respondents who are aware that grade X teachers use digital devices to perform specific teaching activities X (some lessons or more)
Use - Planning	- Percentage of respondents who are aware that grade X teachers use digital devices or ICT in aspects of lesson preparation (6 in total) (once a week or more) - Percentage of respondents who are aware that grade X teachers use digital devices or ICT in specific aspects X of lesson preparation (once a week or more)
Self-Efficacy	- Percentage of respondents who are confident that grade X teachers can perform ICT tasks (6 in total) (moderately or very confident) - Percentage of respondents who are confident that grade X teachers can perform specific ICT tasks X (moderately or very confident)

Indicator – Teacher De Facto Policies

Type of indicator

Pillar: Teachers
Level: De Facto Policies
Questionnaire: School Survey
Respondent: Principal or Teacher

Definition

The *Teacher De Facto Policies* indicator assesses the respondents' awareness of grade X teachers ICT skills and teachers' professional development. The indicator tracks three aspects: 1) the existence of standards/competency framework, 2) the presence of a support system for teachers through training and professional development, and 3) the presence of an evaluation system.

Background & Rationale

In relation to technology, it is a consensus that the effectiveness of the use of ICT at schools depends on what teachers and students make of it (Comi, Argentin, Gui, Origo, & Pagani, 2017). Thus, as Conrads, Rasmussen, Winters, Geniet, and Langer (2017) show in a review of EdTech policies, "supporting teachers and strengthening their capacity to meaningfully integrate digital technologies into education is hence a key priority in current — third-generation — digital education policies" (p. 7).

Results from TALIS 2018 suggest that teacher professional development (TPD) should "move forward from just acquiring the skills to master technological competencies to finding ways to tailor technology to specific subjects and specific activities within those subjects"(OECD, 2019, p. 31). In this regard, probably the most known approach to characterize the knowledge teachers require to incorporate ICT into pedagogical practices is the Technology, Pedagogy, and Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006)1. In a literature review about strategies for developing teachers' TPACK, Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak (2013) conclude that "active involvement in technology-enhanced lesson or course design was found as major strategy, followed by modelling how to teach in a technology-rich environment" (p. 119). Another more recent review found that the most comprehensive TPD models include "translating the knowledge acquire in workshop through lesson development followed by enactment and sometimes with reflective refinement" (Chai, 2019, p. 9).

Considering that teachers' ability to integrate digital technologies meaningfully into daily teaching practice has been confirmed to be a key driver of success (Conrads, et al., 2017), many countries have defined digital competence frameworks for teachers.

[1] Possible instruments to assess TPACK can be found in Scherer, Tondeur, and Siddiq (2017); Yeh, Hsu, Wu, and Chien (2017)

The framework of digital competencies for teachers (as the European Commission (DigCompEdu) (Redecker & Punie, 2017) or the UNESCO ICT competency framework for teachers (UNESCO, 2018b)) defines, in general, three types of competences:

- **Professional engagement**: use of digital technologies for their professional practice, including collaboration, educational management and professional development (courses, communities of practices and other instances).
- **Pedagogy**: how teachers use digital technologies to deliver the curriculum (including planning and preparation, teaching and learning assessment), particularly focusing on innovative pedagogical practices.
- **Teaching digital competences**: how teachers develop students' digital competences.

Questions used for data collection

School survey:

C22. Is there a framework or set of guidelines that defines the digital competences* that a teacher is expected to have or develop?
A digital competence is the knowledge, skills and attitudes that are required when using ICT and digital media to communicate, access, manage, combine, share and evaluate information in order to perform tasks or solve problems.
a. Yes, and this framework/set of guidelines is useful.
b. Yes, but the framework/set of guidelines is not relevant within this school.
c. No, there isn't a framework/set of guidelines.
d. I don't know of such framework/guidelines.

C23. During the last school year, was the grade X teacher formally evaluated on their use of ICT?
a. Yes.
b. No.
c. I don't know

C24. Did the initial training programme taken by the grade X teacher in your school include the following elements?
(1. Yes; 2. No; 9. I don't know)
a. Learning how to use ICT generally.
b. Learning how to use ICT in teaching.

C25. Over the last 12 months, did the grade X teacher participate in any professional development activities on using ICT in teaching and learning practices?
a. Yes. In official training that was required by government.
b. Yes. In official training with optional attendance.
c. Yes. In unofficial training (e.g. meetings) with other principals/teachers where such practices were shared.
d. No.
e. I don't know

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 5 questions, comprising a total of 7 factors, respondents are asked to indicate their awareness of the existence of framework, evaluation system and training. All factors have an equal weight and are scored as indicated below.

Each answer is scored as follows:

Score	Guidelines/usefulness	Evaluation	Training
1	None	No	No
2.5	Yes, not relevant		Yes, in official training with optional attendance OR unofficial training
5	Yes, useful	Yes	Yes, in official training that was required by government
1	I don't know	I don't know	

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	**Name**	**Input**	**Answer scores**	**Calculation**
Sub-indicators	Standards	C22	Usefulness	NA
	Evaluation	C23	Evaluation (yes no)	NA
	Support	C24 a–b C25	Training (yes no)	Average
Indicator	Teachers *de facto* policies	Standard; Evaluation; Support	N/A	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the policy-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	**Statistics**
Standards	- Percentage of respondents who know of the existence of an official digital competency framework (DCF) for teachers and if it is considered useful by the principal
Evaluation	- Percentage of respondents who mentioned that grade X teachers were formally evaluated in the use of ICT
Support	- Percentage of respondents who mentioned that initial teacher training includes learning how to use ICT generally - Percentage of respondents who mentioned that initial teacher training includes learning how to use ICT in teaching - Percentage of respondents who mentioned that initial teacher training taken by grade X teachers included learning how to use ICT - Percentage of respondents who mentioned that initial teacher training taken by grade X teachers included learning how to use ICT in teaching - Percentage of respondents who mentioned that grade X teacher participated in professional development on using ICT in learning and teaching (by type of professional development)

Indicator – Teacher De Jure Policies

Type of indicator

Pillar: Teachers
Level: De Jure Policies
Questionnaire: Policy Survey
Respondents: Policy/education expert

Definition

The *Teacher De Jure Policies* indicator assesses the existence of key elements in the policies that enable teachers to efficiently use and teach ICT in education. The indicator tracks three aspects: 1) the existence of standards/competency framework, 2) the presence of a support system for teachers through training and professional development, and 3) the presence of an evaluation system.

Background & Rationale

In relation to technology, it is a consensus that the effectiveness of the use of ICT at schools depends on what teachers and students make of it (Comi, Argentin, Gui, Origo, & Pagani, 2017). Thus, as Conrads, Rasmussen, Winters, Geniet, and Langer (2017) show in a review of EdTech policies, "supporting teachers and strengthening their capacity to meaningfully integrate digital technologies into education is hence a key priority in current — third-generation — digital education policies" (p. 7).

Results from TALIS 2018 suggest that teacher professional development (TPD) should "move forward from just acquiring the skills to master technological competencies to finding ways to tailor technology to specific subjects and specific activities within those subjects"(OECD, 2019, p. 31). In this regard, probably the most known approach to characterize the knowledge teachers require to incorporate ICT into pedagogical practices is the Technology, Pedagogy, and Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006)2. In a literature review about strategies for developing teachers' TPACK, Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak (2013) conclude that "active involvement in technology-enhanced lesson or course design was found as major strategy, followed by modelling how to teach in a technology-rich environment" (p. 119). Another more recent review found that the most comprehensive TPD models include "translating the knowledge acquire in workshop through lesson development followed by enactment and sometimes with reflective refinement" (Chai, 2019, p. 9).

Considering that teachers' ability to integrate digital technologies meaningfully into daily teaching practice has been confirmed to be a key driver of success (Conrads, et al., 2017), many countries have defined digital competence frameworks for teachers.

The framework of digital competencies for teachers (as the European Commission (DigCompEdu) (Redecker & Punie, 2017) or the UNESCO ICT competency framework for teachers (UNESCO, 2018b)) defines, in general, three types of competences:

- **Professional engagement**: use of digital technologies for their professional practice, including collaboration, educational management and professional development (courses, communities of practices and other instances).
- **Pedagogy**: how teachers use digital technologies to deliver the curriculum (including planning and preparation, teaching and learning assessment), particularly focusing on innovative pedagogical practices.
- **Teaching digital competences**: how teachers develop students' digital competences.

[2] Possible instruments to assess TPACK can be found in Scherer, Tondeur, and Siddiq (2017); Yeh, Hsu, Wu, and Chien (2017)

Questions used for data collection

Policy survey:

C11. Does your country have an official digital competency framework for teachers (DCF)? (DCF is a defined set of digital competencies that teachers are expected to develop)
0 = No
1 = Yes

C12. Does this framework define minimum performance standards in ICT that teachers must meet?
0 = No
1 = Yes

C13. Does your country have a mechanism or strategy for assessing teachers' digital competencies?
(0=No; 1=Yes)

C14. Does the typical initial teacher training programme for (ISCED 0 to 4) pre-primary to upper secondary education include the following elements?
a. Learning how to use ICT generally.
(0=No; 1=Yes)
If yes, specify in what year that element was added to the teacher training curriculum of the reference programme:_____
b. Learning how to use ICT in teaching.
(0=No; 1=Yes)
If yes, specify in what year that element was added to the teacher training curriculum of the reference programme:_____

C15. Are public school teachers required to complete training on the use of ICT for teaching and learning as part of their continuing professional development?
(0=No; 1=Yes)

C16. Does the government provide any teacher training programmes within the offer of courses provided by the government to support teachers' continuing professional development on different areas of ICT?
a. Training on basic use of ICT.
(0=No; 1=Yes)
b. Training on ICT for teaching in specific subjects.
(0=No; 1=Yes)
c. Training on ICT for teaching and learning that is not subject-specific.
(0=No; 1=Yes)

Method of calculation and score

The indicator is calculated based on information collected through the politics and policies survey. Through 6 questions, with each a choice of 2 answers based the existence of ICT legal aspects, 9 factors are scored. All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	Yes-No
1	No
5	Yes

The average score across selected factors is calculated to get a system-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Standards	PS C11 PS C12	Framework and standards (yes no)	Average
	Evaluation	PS C13	Evaluation (yes no)	NA
	Support	PS C14 a-b PS C15 PS C16 a-b-c	YInitial raining, continuous training, ICT training	Average
Indicator	Teachers *de jure* policies	Standard; Evaluation; Support	N/A	Average

Potential Statistics to Highlight

Beyond the aggregate indicator score, the policy-level data allows for highlighting key statistics that may strengthen the messaging and improve the communication of the information. Among them:

Sub-indicators	Statistics
Standards	- Existence of an official digital competency framework for teachers that defines minimum performance standards in ICT that teachers. If yes, defines the standards teachers must meet
Evaluation	- Existence of a mechanism or strategy for assessing teachers' digital competencies
Support	- Existence of learning to use ICT in initial teacher training programme (by level of education) - Existence of learning to use ICT in teaching in initial teacher training programme (by level of education) - Existence of teachers' training on basic use of ICT as part of continuing professional development - Existence of teachers' training on ICT for teaching specific subjects as part of continuing professional development - Existence of teachers' training on ICT for teaching and learning no-subject specific as part of continuing professional development

3. Students

Indicator – Student Practices

Type of indicator
Pillar: Students
Level: Practices
Questionnaire: School Survey
Respondent: Principal or Teacher

Definition
The *Student Practices* indicator assesses the performance of grade X students in using ICT in and outside school. The indicator tracks three aspects: 1) the self-efficacy of students in using ICT, 2) the use/frequency with which students use ICT inside the school, and 3) the use/frequency with which students use ICT outside the school.

Background & Rationale
In relation to the practices at the school level, one of the key elements considered in the literature is the adaptation of the curriculum.

Questions used for data collection

School survey:

D26. Thinking about the last 3 months, how often do the grade X students use digital devices for the following activities while in school?
(1. Never or hardly ever; 2. In some lessons; 3. In most lessons; 4. In every lesson; 9. I don't know)
a. Searching for information or data for a project.
b. Communicating with other students on projects.
c. Sharing assignment results or other schoolwork with other students.
d. Submitting completed work for assessment.
e. Evaluating information resulting from a search.
f. Producing a document, presentation, or creating visual outputs or videos.

D27. Thinking about the last 3 months, how often do the students of grade X use digital devices for the following activities outside of school?
(1. Never or hardly ever; 2. Once or twice a month; 3. Once or twice a week; 4. Every day or almost every day; 9. I don't know)
a. Browsing the Internet for schoolwork (e.g. when preparing for an essay or presentation)
b. Using a messaging application (e.g. WhatsApp, Facebook Messenger) or social networks (e.g., Facebook, Twitter) for communication with teachers.
c. Using email for communication with teachers and submission of homework or other schoolwork.
d. Doing homework on a digital device.
e. Using learning apps or learning websites on a digital device.
D28. Approximately what proportion of your grade X students do you think can perform the following activities independently (without assistance)?
(5. Almost all; 4. More than half; 3. About half; 2. Less than half; 1. None; 9 I don't know)
a. Open a new tab in a browser.
b. Save a photo that they find online.
c. Find a website they have visited before.
d. Check if the information they find online is true.
e. Post online videos or music that they have created themselves.
f. Make basic changes to online content that others have created.

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 17 factors, respondents are asked to indicate the level of intensity of key activities (11 factors) and to indicate the relative confidence on students' performance on 6 activities (6 factors). All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	Frequency/level of use in school (lessons)	Frequency/level of use outside of school (time)	Proportion performing independently
1	Never or hardly ever	Never or hardly ever	None or I don't know
2.33	In some lessons	Once or twice a month	About half or less than half
3.67	In most lessons	Once or twice a week	More than half
5	In every or almost every lesson	Every day or almost every day	Almost all

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Use - Inside	C15 a–f	Frequency of use in school (lessons)	Average
	Use - Outside	C16 a–f	Frequency of use outside of school (time)	Average
	Self-efficacy	C17 a–f	Proportion performing independently	Average
Indicator	Student practices	Use - Inside Use - Outside Self-Efficacy	NA	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Use - Inside	- Percentage of respondents who mentioned that grade X students use digital devices in school for 6 activities (some lessons or more) - Percentage of respondents who mentioned that grade X students use digital devices in school for specific activity X (some lessons or more)
Use - Outside	- Percentage of respondents who mentioned that grade X students use digital devices outside of school for 5 activities (once a week or more) - Percentage of respondents who mentioned that grade X students use digital devices outside of school for specific activity X (once a week or more)
Self-Efficacy	- Percentage of respondents who are confident that half of students can independently perform certain activities (6 in total) (moderately, very confident) - Percentage of respondents who are confident that half of students can independently perform specific activity X (moderately, very confident)

Indicator – Student De Facto Policies

Type of indicator

Pillar: Students
Level: De Facto Policies
Questionnaire: School Survey
Respondent: Principal or Teacher

Definition

The *Student De Facto Policies* indicator assesses the respondents' awareness of key elements in the policies that enable students' performances on ICT and their assessment. The indicator tracks three aspects: 1) the existence of a competency framework for students, 2) the integration of ICT in activities in the curriculum and outside the school and 3) the existence of an assessment of ICT competencies.

Background & Rationale

Regarding the development of students' digital skills, it is important that countries define a digital competency framework that goes beyond just technical skills and include these competencies in the curriculum.

Questions used for data collection

School survey:

D29. Does the educational curriculum recommend using ICT in teaching of grade X students?
a. Yes, it does.
b. No, it does not.
c. I don't know

D30. Is there a framework or set of guidelines defining the digital competences* that a student is expected to have or develop?
*A digital competence is the knowledge, skills and attitudes that are required when using ICT and digital media to communicate, access, manage, combine, share and evaluate information in order to perform tasks or solve problems.
a. Yes, and this framework/set of guidelines is useful.
b. Yes, but this framework/set of guidelines is not relevant within this school.
c. No, there is no framework/set of guidelines for students.
d. I don't know of such a framework/guidelines.

D31. During the last school year, were the digital competencies of the grade X students formally evaluated/assessed?
a. Yes.
b. No.
c. I don't know.

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 3 factors, respondents are asked to indicate their awareness of the existence of a framework, evaluation system and training. All factors have an equal weight and are scored indicated below.

Each answer is scored as follows:

Score	Framework/usefulness	ICT in curriculum	Students evaluated
1	None	No	No
2.5	Yes, not relevant		
5	Yes, useful	Yes	Yes
0	I don't know	I don't know	I don't know

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Curriculum	D29	ICT in curriculum (yes no)	NA
	Framework	D30	Framework (usefulness)	NA
	Assessment	D31	Students evaluated (yes no)	NA
Indicator	Students *de facto* policies	Curriculum Framework Assessment	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Curriculum	- Percentage of respondents who know of the existence of recommendations to integrate ICT-assisted instruction at grade X
Framework	- Percentage of respondents who know of the existence of an official digital competency framework (DCF) for students
Assessment	- Percentage of respondents who know that grade X students were formally evaluated in the use of ICT in the last school year

Indicator – Student De Jure Policies

Type of indicator

Pillar: Students
Level: De Jure Policies
Questionnaire: Policy Survey
Respondent: Policy/education expert

Definition

The *Student De Jure Policies* indicator assesses the existence of key elements in the policies that enable students to efficiently use and by assessed by and on ICT. The indicator tracks three aspects: 1) the existence of a competency framework for students, 2) the integration of ICT in activities in the curriculum and outside the school and 3) the existence of an assessment of students' ICT competencies.

Background & Rationale

One of the seven dimensions of the European Commission framework to guide educational institutions in their adoption of digital technologies is related to content and curricula (Kampylis, Punie, & Devine, 2015). They note that there is a need to adapt the curriculum to take advantage of the leverage potential of digital learning technologies and digital content to modernize teaching, learning and assessment practices and improve the scope of learning outcomes.

One of the ISTE 14 critical elements necessary for institutions to effectively leverage technology for learning (ISTE, 2020) is having a Curriculum Framework, meaning that there are content standards and related digital curriculum resources and they should be aligned with and support digital age learning and work.

Despite the particular digital competence framework adopted (for example: Carretero, Vuorikari, & Punie, 2017; European Union, 2019; Fraillon, Ainley, Schulz, Friedman, et al., 2019; Laanpere, 2019; Law, et al., 2018; UNESCO, 2018a; Vuorikari, Punie, Carretero, & Van den Brande, 2016; WEF, 2015), regarding EdTech policies, it is important that:

- The policy defines a competency framework that goes beyond just technical skills.
- Digital competencies are included in the curriculum, across grades and subject areas.
- Strategies to promote the development of students' digital competences.
- There is a mechanism to assess students' digital competences.

Questions used for data collection

Policy survey:

D17. Does your country's educational curriculum recommend that ICT-assisted instruction forms part of subject delivery for specific grade(s)?
(0=No; 1=Yes)

D19. Does your country's educational curriculum define a set of digital or ICT competencies that students are expected to develop?
(0=No; 1=Yes)

D21. Does your country have a mechanism or strategy for assessing students' digital competencies?
(0=No; 1=Yes)

Method of calculation and score

The indicator is calculated based on information collected through the politics and policies survey. Through 3 questions, with each a choice of 2 answers based the existence of ICT legal aspects, 3 factors are scored. All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	ICT in curriculum / competencies / assessment
1	No
5	Yes

The average score across selected factors is calculated to get a system-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Curriculum	D17	ICT in curriculum (yes no)	NA
	Framework	D19	ICT competencies (yes no)	NA
	Assessment	D21	Assessment (yes no)	NA
Indicator	Student *de jure* policies	Curriculum Framework Assessment	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Curriculum	- Existence of a digital competency framework for students
Framework	- Existence of recommendation on integration of ICT-assisted instruction to form part of subject delivery at specific grade(s)
Assessment	- Existence of a mechanism to assess students' digital competencies

4. Devices

Indicator – Device Practices
Type of indicator **Pillar:** Devices **Level:** Practices **Questionnaire:** School Survey **Respondent:** Principal or Principal and Teacher (E36 only)
Definition The *Device Practices* indicator assesses the readiness of use digital devices in teaching and learning and their availability in schools. The indicator tracks three aspects: 1) the availability of devices, 2) students' access to the devices, and 3) the existence of technical support.
Background & Rationale Many countries have made significant efforts to enable, guide and foster the use of digital technologies in education, aiming at improving educational outcomes and preparing students to live and work in the 21st century. After decades of investment, there is no consistent evidence of learning improvements at a system level that can be, reasonably, attributed to the use of technology (OECD, 2015). However, results of different meta-analyses of impact evaluations of ICT based educational interventions involving the use of ICT (Chauhan, 2017; Escueta, Nickow, Oreopoulos, & Quan, forthcoming; Escueta, Quan, Nickow, & Oreopoulos, 2017; McEwan, 2015; Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011; Tamim, Borokhovski, Pickup, & Bernard, 2015) show that they (can) have a positive impact on students' learning outcomes. It is a consensus that insufficient access to technology is one of the main factors hindering ICT integration to teaching (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Kim, Kim, Lee, Spector, & DeMeester, 2013; Tondeur, et al., 2012). Regarding the interventions involving the implementation of computer-assisted learning (CAL) models[3], results indicate that interventions designed to support students to develop particular skills have the potential of improving students' learning outcomes (Archer, et al., 2014; Bernard, Borokhovski, Schmid, & Tamim, 2018; Chauhan, 2017), particularly in Mathematics (Bulman & Fairlie, 2016; Escueta, et al., 2017) and when used as a support for instruction (Tamim, et al., 2011). In a recent publication, Bettinger, et al. (2020) show that a blended approach that combines traditional teaching and the use of CAL is more effective than substituting one for the other.
Questions used for data collection E32. How many digital devices (specifically desktop computers, portable computers and/or tablets) are at this school? This includes all devices that might be used by staff or students in the school. An estimate is fine. Number of digital devices: ____ E33. How many digital devices (specifically desktop computers, portable computers and tablets) are currently in working condition at this school? An estimate is fine. Number of digital devices currently in working condition: ____ E34. Out of the digital devices that are currently working, how many are available for students to use for learning activities? An estimate if fine.

[3] The term "computer" is used based on the traditional concept of "Computer Assisted Learning/Instruction", however nowadays it includes the use of a variety of ICT devices, including desktop computers, notebook or laptop computers, netbook computers, tablet devices or smartphones, except when being used for talk and text.

Number of working digital devices that are available to students: _____

E35. Does your school have digital devices that are adapted for the use of students with disabilities?
a. Yes.
b. No.
c. I don't know

E36. How often did the grade X students use these digital devices in class in the last month?
a. Never.
b. Once or twice.
c. Once or twice a week.
d. Every day or almost every day.
e. I don't know.

E39. To what extent do you agree with the following statements about your school?
(1. Strongly disagree, 2. Disagree, 3. Agree, 4. Strongly agree)
a. The number of digital devices for instruction is sufficient to support teaching and learning effectively.
b. The number of digital devices connected to the Internet is sufficient to support teaching and learning effectively
c. The school's Internet bandwidth or speed is sufficient to support teaching and learning effectively.
d. The school's Internet stability (i.e. connection without service interruption) is sufficient to support teaching and learning effectively.
e. There is sufficient technical support to maintain ICT resources so that they are fully functional.

For each school, the average score across all 6 factors is calculated to get a school-level aggregate score. The ultimate aggregate score reported as part of the EdTech Readiness Index is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public).

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 6 questions, comprising a total of 6 factors, respondents are asked to indicate the number of digital devices (2 factors), if they are adapted to students with disabilities (1 factor), the level of frequency of usage (1 factor) and to indicate the relative level of agreement with two statements (2 factors). All factors have an equal weight and are scored as indicated below.

Each factor is scored as follows:

Score	Share of working digital devices available to students (E34/E33)
1	Less than 20%
2	Between 20% and 40%
3	Between 40% and 60%
4	Between 60% and 80%
5	More than 80%

Score	Adapted for disability	Frequency of device use in class (time)	Agreement that there are sufficient devices for instruction	Agreement that there is sufficient technical support
1	No	Never	Strongly disagree	Strongly disagree
2.33		Once or twice	Disagree	Disagree

3.67		Once or twice a week	Agree	Agree
5	Yes	Every day or almost every day	Strongly agree	Strongly agree

For each school, the average score across selected factors is calculated to get 3 school-level sub-indicator scores. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Student Access	100*E34/ E33 E39 a	Share of working digital devices available to students Agreement that there are sufficient devices for instruction	Average
	Student Use	E35 (adapted for use of disabilities) E36	Adapted for disability (yes no) Frequency of device use in class (time)	Average
	Support	E39 e	Agreement that there is sufficient technical support to maintain functional resources	Average
Indicator	Devices practices	Availability Student Access Support	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Availability	- Percentage of digital devices that are currently in working condition
Student Access	- Percentage of digital devices that are currently in working condition and available for students to use for learning activities - Percentage of respondents who mentioned that the school digital devices are adapted for the use of students with disabilities
Support	- Percentage of respondents who agree that the number of digital devices for instruction is sufficient to support teaching and learning effectively (agree, strongly agree) - Percentage of respondents who agree that there is sufficient technical support to maintain ICT resources so that they are fully functional (agree, strongly agree) - Percentage of respondents who mentioned that students used ICT devices in class last month (once a week or more)

Indicator – Device De Facto Policies

Type of indicator

Pillar: Devices
Level: De Facto Policies
Questionnaire: School survey
Respondent: Principal

Definition

The *Device De Facto Policies* indicator assesses the respondents' awareness of key elements in policies related to digital devices in schools. The indicator tracks three aspects: 1) the existence of availability standards, 2) the existence of monitoring tools and 3) the knowledge of the assignment of responsibilities for maintenance and support .

Background & Rationale

Evidence shows that the lack of certain conditions can act as barriers for the use of technology (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014; Law, et al., 2008) and what really matters is that individuals and institutions have the option to use them (Martínez & Ramos, 2020). Therefore, EdTech policies should include strategies to ensure:

- Organizational arrangements to ensure the availability of the computers (e.g. time tables or other types of mechanisms to organize the use).
- Technical and pedagogical support for teachers.
- Procedures to administer and maintain the technological infrastructure.
- Technology renewal strategy.

Synthesizing, the evidence supports the idea that digital technologies can help to improve educational outcomes. However, in order to maximize the possibilities to realize its potential at a system level, two necessary points (out of 6 recommendations) are linked to ICT infrastructure:

- Enable access to a variety of quality ICT devices, content and tools that are readily available and are of standard quality.
- Promote pedagogical approaches based on computer-assisted learning models tailored to the context, particularly teachers and students' skills.

Questions used for data collection

School survey:

E41. Do you know if there are standards in place which require that students in all [public/private] schools have access to functioning digital devices (PCs, laptops, tablets and/or other digital devices)?
a. Yes.
b. No.
c. I don't know
E43. Is there someone any institution or mechanism (such as education information system, regular survey, etc.) that monitors any of the following?
(1. Yes, there is; 2. No, there isn't; 3. I don't know)
a. That all public schools have access to functioning digital devices (PCs, laptops, tablets, mobiles, etc.).
b. Availability of an Internet connection
c. If digital devices and connectivity are used by the students.

E44. Is there government legislation that assigns responsibility for maintaining public school ICT infrastructure and technical support?
a. Yes, those responsibilities are mainly assigned to the national government level.

b. Yes, those responsibilities are mainly assigned to the subnational/local education authority level.
c. Yes, those responsibilities are assigned to the school level.
d. No, those responsibilities are not given to any level of school government.
e. I don't know.

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 4 factors, respondents are asked to indicate their awareness of the devices' availability (1 factor), the existence of a monitoring framework (2 factors) and the existence of technical support. All factors have an equal weight and are scored as indicated below.

Each answer is scored as follows:

Score	Standards	Monitoring	Responsibility for support
1	No	No	No
5	Yes	Yes	Yes, national, sub-national, local or school
1	I don't know	I don't know	I don't know

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	**Name**	**Input**	**Answer scores**	**Calculation**
Sub-indicators	Standards	E41	Standards (yes no)	N/A
	Monitoring	E43 a, c	Monitoring (yes no)	Average
	Responsibility	E44	Responsibility for support	Average
Indicator	Devices *de facto* policies	Standards Monitoring Responsibility	N/A	Average

Potential Statistics to Highlight

Sub-indicators	**Statistics**
Standards	- Percentage of respondents who know of the existence of a policy that requires students to have access to digital devices
Monitoring	- Percentage of respondents who know of the existence of a mechanism that monitors that all public schools have access to functioning digital devices - Percentage of respondents who know of the existence of a mechanism that monitors usage of digital devices by students
Responsibility	- Percentage of respondents who know of the existence of a policy assigning responsibility for the maintenance and technical support of digital devices

Indicator – Device De Jure Policies

Type of indicator

Pillar: Devices
Level: De Jure Policies
Questionnaire: Policy Survey
Respondents: Policy/education expert

Definition

The *Device De Jure Policies* indicator assesses the existence of key elements in the policies related to digital devices in schools. The indicator tracks three aspects: 1) the existence of availability standards, 2) the existence of monitoring tools and 3) the assignment of responsibilities for maintenance and support .

Background & Rationale

Evidence shows that the lack of certain conditions can act as barriers for the use of technology (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014; Law, et al., 2008) and what really matters is that individuals and institutions have the option to use them (Martínez & Ramos, 2020). Therefore, EdTech policies should include strategies to ensure:

- Organizational arrangements to ensure the availability of the computers (e.g. time tables or other types of mechanisms to organize the use).
- Technical and pedagogical support for teachers.
- Procedures to administer and maintain the technological infrastructure.
- Technology renewal strategy.

Synthesizing, the evidence supports the idea that digital technologies can help to improve educational outcomes. However, in order to maximize the possibilities to realize its potential at a system level, two necessary points (out of 6 recommendations) are linked to ICT infrastructure:

- Enable access to a variety of quality ICT devices, content and tools that are readily available and are of standard quality.
- Promote pedagogical approaches based on computer-assisted learning models tailored to the context, particularly teachers and students' skills.

Questions used for data collection

Policy survey:

E22. Is there a policy or are there standards in place which require that students in all public schools have access to PCs, laptops, tablets, and/or other digital devices?
(0=No; 1=Yes)

E23. Is there a policy in place which requires that digital devices that support learning at the school are accessible to children with disabilities?
(0=No; 1=Yes)

E24. Is there government legislation and/or policies that assign responsibility for maintaining public school ICT infrastructure and technical support?
1. Yes, those responsibilities are mainly assigned to the national level.
2. Yes, those responsibilities are mainly assigned to the sub-national levels.
3. Yes, those responsibilities are mainly assigned to the local levels.
4. Yes, those responsibilities are assigned to the school level.
5. Responsibilities are not explicitly assigned in the legislation and/or policies.

E25. Is there a central system or mechanism that monitors the availability of functioning digital devices for the students and their usage in all public schools?
0 = No
1 = Yes, it monitors the availability of digital devices for the students, but it does not monitor if they are functioning or used.
2 = Yes, it monitors the availability of digital devices for the students and if they are functioning, but it does not monitor if they are used.
3 = Yes, it monitors the availability of functioning digital devices for the students and if the devices are used.

Method of calculation and score

The indicator is calculated based on information collected through the politics and policies survey. Through 4 questions, with each choice of answers based the existence of ICT legal aspects and certain levels applied, 4 factors are scored. All factors have an equal weight and are scored as indicated below.

Each factor is scored as follows:

Score	Standards for access	Accessible to disabilities	Allocation of responsibilities	Monitoring
1	No	No	No, responsibilities are not assigned	No
2.33		Yes, numbers		Yes, available
3.67		Yes, working condition		Yes, available and functioning
5	Yes	Yes, usage	Yes, any level	Yes, available, functioning and used

The average score across selected factors is calculated to get a system-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Standards	E22 and E23	Standards for access (yes no) and Accessible for disabilities (yes no)	Average
	Monitoring	E25	Monitoring	N/A
	Responsibility	E24	Allocation of responsibilities (yes no)	N/A
Indicator	Devices *de jure* policies	Standards Monitoring Responsibility	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Standards	- Existence of a policy or standards for digital device availability in public schools - Existence of a policy that requires that digital devices that support learning at schools are accessible to children with disabilities

Monitoring	- Existence of a central system or mechanism that monitors the availability of digital devices - Existence of a central system or mechanism that monitors the availability of functional digital devices - Existence of a central system or mechanism that monitors the availability and usage of functional digital devices
Responsibility	- Existence of a legislation or policy that assigns responsibility for maintaining public school ICT infrastructure and technical support for digital devices to a specific government level - Existence of a legislation or policy that assigns the responsibility for maintaining ICT infrastructure and technical support for digital devices to the school

5. Connectivity

Indicator – Connectivity Practices

Type of indicator
Pillar: Connectivity
Level: Practices
Questionnaire: School Survey
Respondent: Principal

Definition
The C*onnectivity Practices* indicator assesses the readiness of schools to connect students to internet. The indicator tracks three aspects: 1) the level of connectivity available, 2) student access to the internet, and 3) the perceived quality of the connectivity.

Background & Rationale
Providing Internet connectivity to the schools has been a priority for EdTech policies for the last decades. Although the percentage of schools that have internet connection has increased, the following challenges persist: (i) connecting all schools to internet, especially those in rural areas, (ii) ensuring certain level of internet connection quality (speed and reliability) and (iii) ensuring an affordable cost of the connection.

Regarding the quality of the Internet, apart from the reliability of the connection, the download speed is a critical variable.
The most frequent school-related activity with ICT reported by students in ICILS was to use the internet to do research (Fraillon, Ainley, Schulz, Friedman, et al., 2019), which according to the estimations of SEDTA (Fox and Jones (2016, p. 10)), requires 1Mbps per student. Also, other activities such as downloading digital instructional materials and using email require similar internet bandwidth download speeds.

Questions used for data collection

School survey:
E34. Out of the digital devices that are currently working, how many are available for students to use for learning activities?
Number of working digital devices that are available to students: _____

E37. Does this school have Internet access?
a. Yes.
b. No.

E38. Approximately, how many of all digital devices (computers, portable computers and tablets) available to students in the school are connected to the Internet?
Number of digital devices available to students and connected to Internet: _____

E39. To what extent do you agree with the following statements about your school?
(1. Strongly disagree, 2. Disagree, 3. Agree, 4. Strongly agree)
a. The number of digital devices for instruction is sufficient to support teaching and learning effectively.
b. The number of digital devices connected to the Internet is sufficient to support teaching and learning effectively.
c. The school's Internet bandwidth or speed is sufficient to support teaching and learning effectively.
d. The school's Internet stability (i.e. connection without service interruption) is sufficient to support teaching and learning effectively.
e. There is sufficient technical support to maintain ICT resources so that they are fully functional.

d. The school's Internet stability (i.e. connection without service interruption) is sufficient to support teaching and learning effectively.

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 4 questions, comprising a total of 5 factors, respondents are asked to indicate if there is internet at school and the number of digital devices connected to internet (2 factors) and to indicate the relative level of agreement with three statements (3 factors). All factors have an equal weight and are scored as indicated below.

Each factor is scored as follows:

Score	Share of devices available to students that are connected to Internet
1	Less than 20%
2	Between 20% and 40%
3	Between 40% and 60%
4	Between 60% and 80%
5	More than 80%

Score	Internet access	Agreement
1	No	Strongly disagree
2.33		Disagree
3.67		Agree
5	Yes	Strongly agree

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Availability	E37	School has Internet access (yes no)	N/A
	Student Access	100 * E38 / E34 E39 b	Share of devices available to students that are connected to Internet No. of devices connected to Internet is sufficient	Average
	Quality	E39 c, d (internet bandwidth is sufficient, internet stability is sufficient)	Agreement that Internet bandwidth is sufficient, Internet stability is sufficient	Average
Indicator	Connectivity practices	Availability; Student Access; Quality	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Availability	- Percentage of respondents who mentioned that their school is connected to internet
Student Access	- Percentage of digital devices available to students that are connected to internet - Percentage of respondents who agree that the number of digital devices connected to the internet is sufficient to support teaching and learning effectively (agree, strongly agree)
Quality	- Percentage of respondents who agree that the school bandwidth or speed is sufficient to support teaching and learning effectively (agree, strongly agree) - Percentage of respondents who agree that the school Internet stability is sufficient to support teaching and learning effectively (agree, strongly agree)

Indicator – Connectivity De Facto Policies

Type of indicator

Pillar: Connectivity
Level: De Facto Policies
Questionnaire: School Survey
Respondent: Principal

Definition

The C*onnectivity De Facto Policies* indicator assesses respondents' awareness of key elements in the policies related to internet connectivity in schools. The indicator tracks three aspects: 1) the existence of a connectivity plan, 2) the existence of monitoring tools and 3) the existence of technical support.

Background & Rationale

Providing Internet connectivity to the schools has been a priority for EdTech policies for the last decades. Although the percentage of schools that have internet connection has increased, the following challenges persist: (i) connecting all schools to internet, especially those in rural areas, (ii) ensuring certain level of internet connection quality (speed and reliability) and (iii) ensuring an affordable cost of the connection.

Regarding the quality of the Internet, apart from the reliability of the connection, the download speed is a critical variable.
The most frequent school-related activity with ICT reported by students in ICILS was to use the internet to do research (Fraillon, Ainley, Schulz, Friedman, et al., 2019), which according to the estimations of SEDTA (Fox and Jones (2016, p. 10)), requires 1Mbps per student. Also, other activities such as downloading digital instructional materials and using email require similar internet bandwidth download speeds.

The provision of internet connectivity should consider strategies to ensure its availability in urban and rural schools, mechanisms to moderate the costs of its use in education and standards to define minimum levels of quality in terms of internet download speed (e.g. between 50 and 100 Kbps per student).
Making the connection to Internet affordable should be considered in the EdTech policy.

Questions used for data collection

School survey:

E40. If your school has problems with Internet connectivity, such as stability, low bandwidth, etc., is there a system or mechanism at the government level to assist you and resolve the problem?
a. Yes, I have used it.
b. Yes, but I have not used it.
c. No, there is no system.
d. I don't know.

E42. Does the government have any strategy or plan to provide or facilitate Internet connectivity to all public schools?
a. Yes.
b. No.
c. I don't know.

E43. Is there someone or any institution or mechanism (such as education information system, regular survey, etc.) that monitors any of the following?
(1. Yes, there is; 2. No, there isn't; 3. I don't know)
a. That all public schools have access to functioning digital devices (PCs, laptops, tablets, mobiles, etc.)
b. Availability of an Internet connection.
c. If digital devices and connectivity are used by the students

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 3 factors, respondents are asked to indicate their awareness of the devices' availability, the existence of a monitoring framework and the existence of technical support. All factors have an equal weight and are scored the same way.

Each answer is scored as follows:

Score	Technical support	Strategy to connect schools	Monitoring if connection
1	No	No	No, there isn't
5	Yes, used or not	Yes	Yes, there is
1	I don't know	I don't know	I don't know

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Support system	E40	Technical support (yes no)	N/A
	Plan	E42	Strategy to connect schools (yes no)	N/A
	Monitoring	E43 b	Monitoring if connection (yes no)	N/A
Indicator	Connectivity *de facto* policies	Support Plan Monitoring	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Support	- Percentage of respondents who know of the existence of a central system or mechanism to assist schools with Internet connectivity problems
Plan	- Percentage of respondents who know of the existence a government strategy or plan to connect all public schools to Internet
Monitoring	- Percentage of respondents who know if there is an institution or a mechanism to monitor that all public schools are connected to the Internet

Indicator – Connectivity De Jure Policies

Type of indicator

Pillar: Connectivity
Level: De Jure Policies
Questionnaire: Policy Survey
Respondent: Policy/education expert

Definition

The *Device De Jure Policies* indicator assesses the existence of key elements in the policies that enable all public schools to be connected efficiently to internet. The indicator tracks three aspects: 1) the existence of a connectivity plan, 2) the existence of monitoring tools and 3) the existence of technical support.

Background & Rationale

Providing Internet connectivity to the schools has been a priority for EdTech policies for the last decades. Although the percentage of schools that have internet connection has increased, the following challenges persist: (i) connecting all schools to internet, especially those in rural areas, (ii) ensuring certain level of internet connection quality (speed and reliability) and (iii) ensuring an affordable cost of the connection.

Regarding the quality of the Internet, apart from the reliability of the connection, the download speed is a critical variable.
The most frequent school-related activity with ICT reported by students in ICILS was to use the internet to do research (Fraillon, Ainley, Schulz, Friedman, et al., 2019), which according to the estimations of SEDTA (Fox and Jones (2016, p. 10)), requires 1Mbps per student. Also, other activities such as downloading digital instructional materials and using email require similar internet bandwidth download speeds.

The provision of internet connectivity should consider strategies to ensure its availability in urban and rural schools, mechanisms to moderate the costs of its use in education and standards to define minimum levels of quality in terms of internet download speed (e.g. between 50 and 100 Kbps per student).
Making the connection to Internet affordable should be considered in the EdTech policy.

Questions used for data collection

Policy survey:

F26. Is there a national policy, strategy or plan to provide Internet connectivity to all public schools?
(0=No; 1=Yes); only if 'yes', go to next two questions

F27. Does the national policy, strategy or plan define any quality standards for the Internet connection in public schools?
(0=No; 1=Yes)

F28. Does the national policy, strategy or plan define any mechanism to moderate the cost of Internet use in education to make it affordable?
(0=No; 1=Yes)

F29. Is there a central system or mechanism to monitor the availability of Internet connections in all public schools?
(0=No; 1=Yes)

F30. Is there a central system or mechanism to assist schools with problems related to Internet connectivity, such as Internet stability, low bandwidth, etc.?
(0=No; 1=Yes)

Method of calculation and score

The indicator is calculated based on information collected through the politics and policies survey. Through 5 questions, with each choice of answers based the existence of ICT legal aspects, 3 factors are scored. All factors have an equal weight and are scored as indicated below.

Each factor is scored as follows:

Score	Plan for connectivity (with standards and cost)	System to monitor availability	System to support schools
1	No	No	No
2.33	Yes, without standards and cost		
3.67	Yes, with standards or cost		
5	Yes, with standards and cost	Yes	Yes

For each school, the average score across all 5 factors is calculated to get a school-level aggregate score. The ultimate aggregate score reported as part of the EdTech Readiness Index is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public). The average score across selected factors is calculated to get a school-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Support	F30	System to support schools (yes no)	N/A
	Plan	F26 F27 F28	Plan for connectivity, plan includes standards, plan moderates cost	Average
	Monitoring	F29	System to monitor availability (yes no)	N/A
Indicator	Connectivity *de jure* policies	Support Plan Monitoring	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Support	- Existence of a central system or mechanism to assist schools with Internet connectivity problems
Plan	- Existence of an Internet connectivity policy, strategy or plan for public schools

	- Existence of quality standards in the Internet connectivity policy, strategy or plan - Existence of a mechanism to moderate the cost of Internet in the Internet connectivity policy, strategy or plan
Monitoring	- Existence of a central system or mechanism to monitor the availability of Internet connections in public schools

6. Digital Education Resources

Indicator – Digital Education Resource Practices

Type of indicator
Pillar: Digital Resources
Level: Practices
Questionnaire: School Survey
Respondent: Principal or Principal and Teacher (F46 only)

Definition
The *Digital Resources Practices* indicator assesses the readiness of school to use quality digital educational resources. The indicator tracks three aspects: 1) access to digital resources, 2) use of digital resources, and 3) quality of digital resources.

Background & Rationale
From an EdTech policy perspective, there are three main trends: (i) fostering the use of Open Educational Resources (OER), (ii) providing curriculum related resources through educational portals or digital textbooks, and (iii) distributing subject specific educational software.

Regarding OER, although its use in education is not new (OECD, 2007b), recently UNESCO Member States agreed on a recommendation to "support the creation, use and adaptation of inclusive and quality OER, and facilitate international cooperation in this field". The recommendation addresses five objectives: (i) building capacity of stakeholders to create, access, re-use, adapt and redistribute OER; (ii) developing supportive policy; (iii) encouraging inclusive and equitable quality OER; (iv) nurturing the creation of sustainability models for OER, and (v) facilitating international cooperation. They define OER as "are teaching, learning and research materials that make use of appropriate tools, such as open licensing, to permit their free reuse, continuous improvement and repurposing by others for educational purposes" (UNESCO, 2019, p. 9).

UNESCO (2019) points out that the use of OER can help to alleviate some of the resource-related challenges that many countries face, particularly, the shortage of resources supporting inclusive education, Indigenous language-based and culturally relevant resources, gender-responsive resources and others. Also, others claim that they can become catalysts for general reforms and improvement in educational provision, because they encourage social innovation, which can facilitate changed forms of interaction between teachers, learners and knowledge (Orr, Rimini, & Van Damme, 2015).

Regarding the provision of curriculum related materials on the Internet, many Ministries of Education worldwide have been using the web as a distribution channel for their teaching and learning resources. Generally, they organize these resources as to be accessed through an Educational Portal that facilitates teachers, students and parents search for relevant resources.

Despite the strategies that countries use to enable and foster the use of digital resources to support learning, it is important "to ensure that carefully-won elements of learning, stimulated and supported by high quality [printed] textbooks, are not lost carelessly" (Oates, 2014, p. 5). The literature points to the need for countries to

define standards that ensure the quality of digital educational resources and a mechanism to evaluate them (Gil-Flores, et al., 2017). Some of the key aspects to consider in the evaluation are:

- Technical quality: functional and usability aspects
- Inclusiveness: free of any cultural, gender or other form of bias
- Responsive: possible to be used in multiple devices, including mobile phones.
- Curriculum alignment: content and pedagogy

Questions used for data collection

School survey:

F45. To what extent do you agree or disagree with the following statements about using digital learning resources in teaching at your school?
(1. Strongly disagree, 2. Disagree, 3. Agree, 4. Strongly agree)
a. My school has access to sufficient digital learning resources (e.g. learning software or apps).
b. The available digital learning resources are of adequate quality.
c. The available digital learning resources are aligned to the needs of the curriculum.
d. The available digital learning resources are adapted to the local context and language needs.
e. The available digital learning resources are adapted for the use of students with disabilities.

F46. How often did the grade X teacher use the following tools in her/his teaching this school year?
(1. Never or hardly ever; 2. In some lessons; 3. In most lessons; 4. In every lesson; 9. I don't know)
a. Computer-based information resources (e.g. topic-related websites, wikis, encyclopedias).
b. Digital resources linked with school textbooks.
c. Digital learning games.
d. Collaborative software (e.g. Google Docs, OneNote).
e. Graphing or drawing software (e.g. Paint, drawing tools).
f. Word-processor software (e.g. Microsoft Word).
g. Presentation software (e.g. Microsoft PowerPoint).

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 3 questions, comprising a total of 12 factors, respondents are asked to indicate the level of agreement with one statement on access to and use of digital resources (5 factors) and to indicate the relative level of frequency of use of seven tools (7 factors). All factors have an equal weight and are scored the same way.

Each factor is scored as follows:

Score	Agreement	Frequency of use of digital tools
1	Strongly disagree	Never or hardly ever
2.33	Disagree	In some lessons
3.67	Agree	In most lessons
5	Strongly agree	In every or almost every lesson

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (e.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Access	SS F45 a, e	Agreement of access to DER, agreement DER	Average

			are adapted for disabilities	
	Quality	SS F45 b, c, d	Agreement DER has sufficient quality, agreement DER aligned to curriculum, agreement DER adapted to context	Average
	Use	SS F46 a–g	Frequency of use of digital tools (lessons)	Average
Indicator	Digital resources practices	Access Quality Use	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Access	- Percentage of respondents who agree that their school has access to sufficient digital learning resources (agree, strongly agree) - Percentage of respondents who agree the available digital learning resources are adapted to the needs of students with disabilities (agree, strongly agree)
Quality	- Percentage of respondents who agree that the available digital learning resources are of adequate quality (agree, strongly agree) - Percentage of respondents who agree the available digital learning resources are aligned with the curriculum (agree, strongly agree) - Percentage of respondents who agree the available digital learning resources are adapted to the local context or language (agree, strongly agree)
Use	- Percentage of respondents who are aware that grade X teachers use different tools in their teaching (7 tools in total) (some lessons or more) - Percentage of respondents who are aware that grade X teachers use tool X in their teaching (some lessons or more)

Indicator – Digital Education Resource De Facto Policies

Type of indicator

Pillar: Digital Education Resources
Level: De Facto Policies
Questionnaire: School Survey
Respondent: Principal

Definition

The *Digital Resources De Facto Policies* indicator assesses respondents' awareness of key elements in policies related to the use of quality digital educational resources. The indicator tracks three aspects: 1) the knowledge of a strategy to ensure access to digital education resources, 2) the knowledge of a legislation/policy defining quality standards for digital education resources and 3) the knowledge of guidance to ensure alignment with the curriculum.

Background & Rationale

For the provision of digital educational resources, countries should define robust but flexible standards that ensure their quality and an ongoing mechanisms/processes to evaluate them, including technical quality, inclusiveness, responsiveness and a clear alignment to the curriculum.

One of the ISTE 14 critical elements necessary for institutions to effectively leverage technology for learning (ISTE, 2020) is having a Curriculum Framework, meaning that there are content standards and related digital curriculum resources and they should be aligned with and support digital age learning and work.

Synthesizing, the evidence supports the idea that digital technologies can help to improve educational outcomes. However, in order to maximize the possibilities to realize its potential at a system level, one necessary point (out of 6 recommendations) is linked to digital resource: Foster the use of digital educational resources that can be used to support instruction.

From an EdTech policy perspective, there are three main trends: (i) fostering the use of Open Educational Resources (OER), (ii) providing curriculum related resources through educational portals or digital textbooks, and (iii) distributing subject specific educational software.

Regarding OER, UNESCO Member States agreed on a recommendation to "support the creation, use and adaptation of inclusive and quality OER, and facilitate international cooperation in this field". The recommendation addresses five objectives: (i) building capacity of stakeholders to create, access, re-use, adapt and redistribute OER; (ii) developing supportive policy; (iii) encouraging inclusive and equitable quality OER; (iv) nurturing the creation of sustainability models for OER, and (v) facilitating international cooperation (UNESCO, 2019, p. 9).

Countries should define standards that ensure the quality of digital educational resources and a mechanism to evaluate them (Gil-Flores, et al., 2017). Some of the key aspects to consider in the evaluation are:

- Technical quality: functional and usability aspects
- Inclusiveness: free of any cultural, gender or other form of bias
- Responsive: possible to be used in multiple devices, including mobile phones
- Curriculum alignment: content and pedagogy

Questions used for data collection

School survey:

F47. Is there government legislation/policy about digital education resources that defines any of the following? (1. Yes; 2. No; 3. I don't know)

a. A strategy for ensuring that public schools have access to digital educational resources.
b. Quality standards for digital educational resources.
c. How DERs should be aligned to the curriculum's requirements.
d. How DERs should be adapted to the local culture or language.
e. How DERs should be adapted for the use of students with disabilities.

Method of calculation and score

The indicator is calculated based on information collected through the school survey. Through 1 question, comprising a total of 5 factors, respondents are asked to indicate their awareness of legislations' content about digital resources. All factors have an equal weight and are scored the same way.

Each answer is scored as follows:

Score	Legislation for DER
1	No
5	Yes
1	I don't know

For each school, the average score across selected factors is calculated to get a school-level sub-indicator score. Then, the 3 sub-indicator scores are averaged to calculate the school-level indicator score. The ultimate aggregate scores reported is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public). The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Strategy	SS F47 a	Legislation for DER access (yes no)	N/A
	Standards	SS F47 b	Legislation for quality standards (yes no)	N/A
	Guidance	SS F47 c, d, e	Legislation for aligning DER to curriculum, adapting DER to culture, adapting DER for disabilities (yes no)	Average
Indicator	Digital Education Resources *de facto* policies	Strategy Standards Guidance	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Strategy	- Percentage of respondents who know of the existence of a policy with a strategy to ensure that public schools have access to digital educational resources

Standards	- Percentage of respondents who know of the existence of a policy that defines quality standards for digital educational resources
Guidance	- Percentage of respondents who know of the existence of a policy that defines procedures or mechanisms for aligning digital educational resources with the curriculum - Percentage of respondents who know of the existence of a policy that defines procedures or mechanisms for aligning digital educational resources with the local culture or language - Percentage of respondents who know of the existence of a policy that defines procedures or mechanisms for aligning digital educational resources with the needs of students with disabilities

Indicator – Digital Resource De Jure Policies

Type of indicator

Pillar: Digital Resources
Level: De Jure Policies
Questionnaire: Policy Survey
Respondent Policy/education expert

Definition

The *Digital Resources De Jure Policies* indicator assesses the existence of key elements in the policies that promote the use of quality digital educational resources. The indicator tracks three aspects: 1) the existence of a strategy to ensure access to digital education resources, 2) the existence of a legislation/policy defining quality standards for digital education resources and 3) the existence of guidance to ensure alignment with the curriculum.

Background & Rationale

For the provision of digital educational resources, countries should define robust but flexible standards that ensure their quality and an ongoing mechanisms/processes to evaluate them, including technical quality, inclusiveness, responsiveness and a clear alignment to the curriculum.

One of the ISTE 14 critical elements necessary for institutions to effectively leverage technology for learning (ISTE, 2020) is having a Curriculum Framework, meaning that there are content standards and related digital curriculum resources and they should be aligned with and support digital age learning and work.

Synthesizing, the evidence supports the idea that digital technologies can help to improve educational outcomes. However, in order to maximize the possibilities to realize its potential at a system level, one necessary point (out of 6 recommendations) is linked to digital resource: Foster the use of digital educational resources that can be used to support instruction.

From an EdTech policy perspective, there are three main trends: (i) fostering the use of Open Educational Resources (OER), (ii) providing curriculum related resources through educational portals or digital textbooks, and (iii) distributing subject specific educational software.

Regarding OER, UNESCO Member States agreed on a recommendation to “support the creation, use and adaptation of inclusive and quality OER, and facilitate international cooperation in this field”. The recommendation addresses five objectives: (i) building capacity of stakeholders to create, access, re-use, adapt and redistribute OER; (ii) developing supportive policy; (iii) encouraging inclusive and equitable quality OER; (iv) nurturing the creation of sustainability models for OER, and (v) facilitating international cooperation (UNESCO, 2019, p. 9).

Countries should define standards that ensure the quality of digital educational resources and a mechanism to evaluate them (Gil-Flores, et al., 2017). Some of the key aspects to consider in the evaluation are:

- Technical quality: functional and usability aspects
- Inclusiveness: free of any cultural, gender or other form of bias
- Responsive: possible to be used in multiple devices, including mobile phones
- Curriculum alignment: content and pedagogy

Questions used for data collection

Policy survey:

G31. Does the legislation and/or policies governing the education system contain any of the following? (0=No; 1=Yes)
a. A strategy for ensuring that there are enough digital educational resources available.
b. Defined quality standards to use when evaluating the quality of digital educational resources.
c. Defined procedures or mechanisms for aligning digital educational resources to the curriculum's requirements.
d. Defined procedures or mechanisms for adapting digital educational resources to the local culture or language.
e. Defined procedures or mechanisms for adapting digital educational resources to students with disabilities.

Method of calculation and score

The indicator is calculated based on information collected through the politics and policies survey. Through 1 question, comprising a total of 5 factors, with each a choice of 2 answers based the legislations' content about digital resources. All factors have an equal weight and are scored the same way.

Each answer is scored as follows:

Score	Legislation contains item
1	No
5	Yes
1	I don't know

For each school, the average score across all 5 factors is calculated to get a school-level aggregate score. The ultimate aggregate score reported as part of the EdTech Readiness Index is the average score across all schools in the sample, or the average score for all schools in applicable groupings (E.g. rural/urban, private/public). The average score across selected factors is calculated to get a school-level sub-indicator score. The 3 sub-indicator scores are averaged to calculate the system-level indicator score. The value range for each score is between 1 and 5.

Type	Name	Input	Answer scores	Calculation
Sub-indicators	Strategy	G31 a	Legislation for DER (yes no)	NA
	Standards	G31 b	Legislation for quality standards (yes no)	NA
	Guidance	G31 c, d, e	Legislation for aligning DER to curriculum, adapting DER to	Average

			culture, adapting DER for disabilities (yes no)	
Indicator	Digital resources *de jure* policies	Strategy Standards Guidance	N/A	Average

Potential Statistics to Highlight

Sub-indicators	Statistics
Strategy	- Existence of a policy or legislation with a strategy that ensures the availability of digital education resources
Standards	- Existence of a policy or legislation that defines quality standards to evaluate the quality of digital education resources
Guidance	- Existence of a policy or legislation that defines procedures or mechanisms for aligning digital education resources with the curriculum - Existence of a policy or legislation that defines procedures or mechanisms for aligning digital education resources with the local culture or language - Existence of a policy or legislation that defines procedures or mechanisms for aligning digital education resources with the needs of students with disabilities

7. References

Archer, K., Savage, R., Sanghera-Sidhu, S., Wood, E., Gottardo, A., & Chen, V. (2014). Examining the effectiveness of technology use in classrooms: A tertiary meta-analysis. Computers & Education, 78, 140-149. doi: 10.1016/j.compedu.2014.06.001

Bernard, R. M., Borokhovski, E., Schmid, R. F., & Tamim, R. M. (2018). Gauging the effectiveness of educational technology integration in education: What the best-quality meta-analyses tell us Learning, Design, and Technology: An International Compendium of Theory, Research, Practice, and Policy (pp. 1-25).

Bettinger, E., Fairlie, R. W., Kapuza, A., Kardanova, E., Loyalka, P., & Zakharov, A. (2020). Does EdTech substitute for traditional learning? Experimental estimates of the educational production function Working Paper Series: National Bureau of Economic Research.

Bulman, G., & Fairlie, R. W. (2016). Technology and education: Computers, software, and the internet NBER Working Paper. Cambridge, MA: The National Bureau of Economic Research.

Chai, C. S. (2019). Teacher professional development for Science, Technology, Engineering and Mathematics (STEM) Education: A review from the perspectives of Technological Pedagogical Content (TPACK). The Asia-Pacific Education Researcher, 28(1), 5-19. doi: 10.1007/s40299-018-0400-7

Comi, S. L., Argentin, G., Gui, M., Origo, F., & Pagani, L. (2017). Is it the way they use it? Teachers, ICT and student achievement. Economics of Education Review, 56, 24-39. doi: 10.1016/j.econedurev.2016.11.007

Conrads, J., Rasmussen, M., Winters, N., Geniet, A., & Langer, L. (2017). Digital education policies in Europe and beyond: Key design principles for more effective policies. In C. Redecker, P. Kampylis, M. Bacigalupo & Y. Punie (Eds.). Luxembourg: Joint Research Centre (JRC).

Chauhan, S. (2017). A meta-analysis of the impact of technology on learning effectiveness of elementary students. Computers & Education, 105, 14-30. doi: 10.1016/j.compedu.2016.11.005

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. Computers & Education, 59(2), 423-435. doi: 10.1016/j.compedu.2012.02.001

Escueta, M., Nickow, A. J., Oreopoulos, P., & Quan, V. (forthcoming). Upgrading education with technology: Insights from experimental research. Journal of Economic Literature.

Escueta, M., Quan, V., Nickow, A. J., & Oreopoulos, P. (2017). Education technology: An evidence-based review. Cambridge, MA: The National Bureau of Economic Research.

Evans, D. K., & Popova, A. (2015). What really works to improve learning in developing countries? An Analysis of Divergent Findings in Systematic Reviews Policy Research Working Paper: World Bank.

Fox, C., & Jones, R. (2016). The broadband imperative II: Equitable access for learning. Washington, DC: State Educational Technology Directors Association (SETDA).

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Duckworth, D. (2019). Preparing for Life in a Digital World: IEA international computer and information literacy study 2018 International Report. Amsterdam, The Netherlands: International Association for the Evaluation of Educational Achievement (IEA).

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). Preparing for Life in a Digital Age: The IEA International Computer and Information Literacy Study International Report: International Association for the Evaluation of Educational Achievement (IEA).

Fullan, M. (2012). Stratosphere: Integrating technology, pedagogy, and change knowledge. Toronto: Pearson Canada Inc.

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J.-J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. Computers in Human Behavior, 68, 441-449. doi: 10.1016/j.chb.2016.11.057

ISTE. (2020, 2020). ISTE Essential Conditions Retrieved May, 2020, from https://www.iste.org/standards/essential-conditions

Kampylis, P., Punie, Y., & Devine, J. (2015). Promoting effective digital-age Learning: A European framework for digitally-competent educational organisations: Joint Research Centre of the European Commission.

Kennisnet. (2015). Four in Balance Monitor 2015: Use and benefits of ICT in education. Zoetermeer.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. Teaching and Teacher Education, 29, 76-85. doi: 10.1016/j.tate.2012.08.005

Law, N., Pelgrum, W. J., & Plomp, T. (2008). Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study. Hong Kong: Springer, Comparative Education Research Centre.

Lawrence, J. E., & Tar, U. A. (2018). Factors that influence teachers' adoption and integration of ICT in teaching/learning process. Educational Media International, 55(1), 79-105. doi: 10.1080/09523987.2018.1439712

Martínez, A. L., & Ramos, L. J. (2020). Practical Guide to Implement Surveys on ICT Use in Primary and Secondary Schools. Sao Paulo: Regional Center for Studies on the Development of the Information Society (Cetic.br) and UNESCO Institute for Statistics (UIS).

McEwan, P. J. (2015). Improving learning in primary schools of developing countries. Review of Educational Research, 85(3), 353-394. doi: 10.3102/0034654314553127

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054.

OECD. (2019). TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners (Vol. I). Paris: Organisation for Economic Co-operation and Development (OECD).

Olszewski, B., & Crompton, H. (2020). Educational technology conditions to support the development of digital age skills. Computers & Education, 150. doi: 10.1016/j.compedu.2020.103849

Redecker, C., & Punie, Y. (2017). European framework for the digital competence of educators: DigCompEdu. Luxembourg: Joint Research Centre (JRC).

Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. Review of Educational Research, 81(1), 4-28. doi: 10.3102/0034654310393361

Tamim, R. M., Borokhovski, E., Pickup, D., & Bernard, R. M. (2015). Large-Scale, Government-Supported Educational Tablet Initiatives. Burnaby, CA: Common Wealth of Learning.

Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. Computers & Education, 59(1), 134-144.

UNESCO. (2019). Guidelines on the development of open educational resources policies. Paris: United Nations Educational, Scientific and Cultural Organization (UNESCO) and Commonwealth of Learning (COL).

UNESCO. (2018b). UNESCO ICT Competency Framework for Teachers. Paris: United Nations Educational, Scientific and Cultural Organization.

Viennet, R., & Pont, B. (2017). Education policy implementation: A literature review and proposed framework Education Working Paper (Vol. 162). Paris: Organisation for Economic Co-operation and Development.

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge - a review of the literature. Journal of Computer Assisted Learning, 29(2), 109-121. doi: 10.1111/j.1365-2729.2012.00487.x

The document *Metadata on the Indicators of the Edtech Readiness Index (ETRI)* was elaborated by the World Bank's Education Global Practice as part of the EdTech Readiness Index. Version 1.0. Published on 22nd of March 2023. For further information please contact: ETRI@worldbank.org.