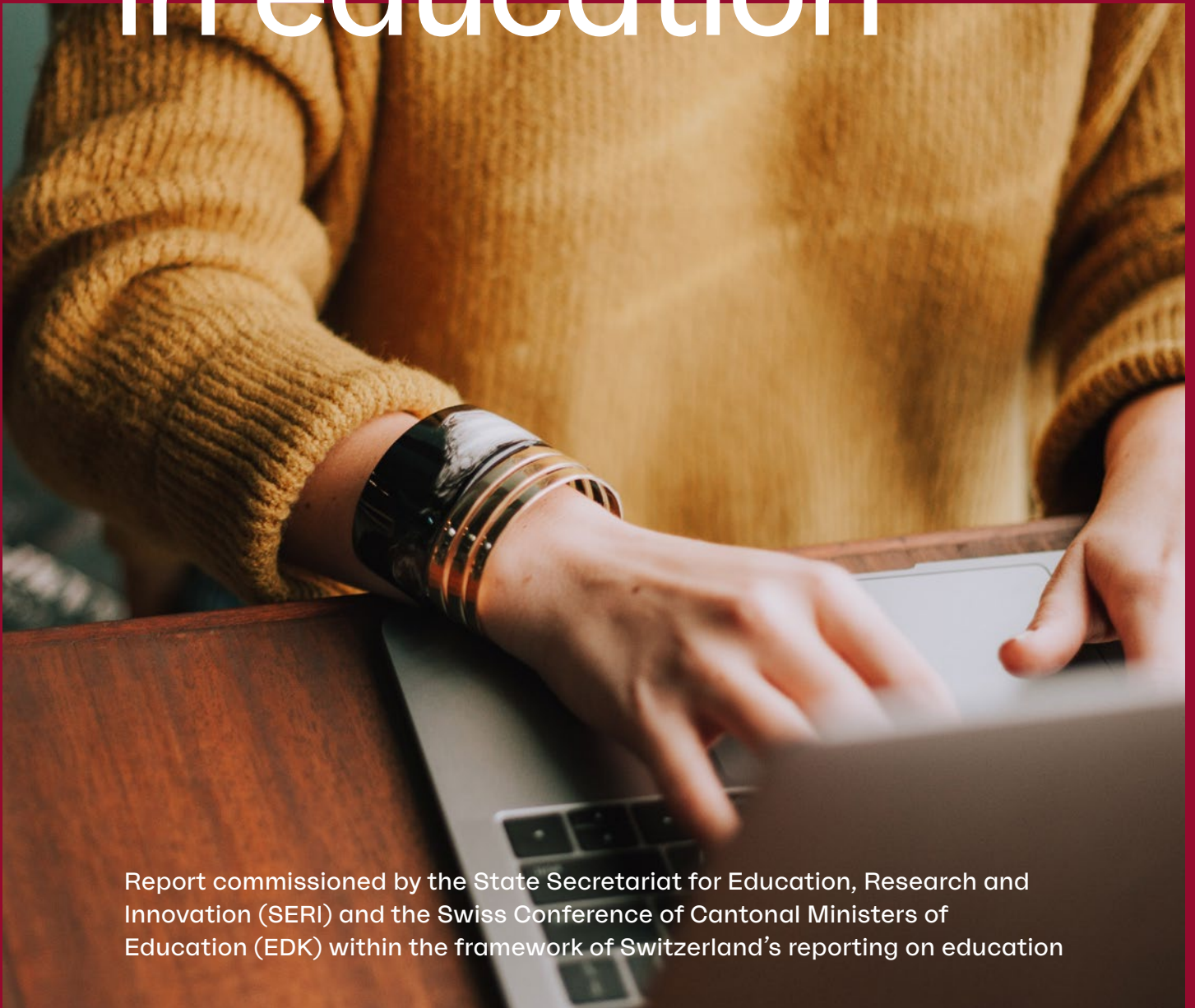


educa

Digitisation in education



Report commissioned by the State Secretariat for Education, Research and Innovation (SERI) and the Swiss Conference of Cantonal Ministers of Education (EDK) within the framework of Switzerland's reporting on education

Digitaler Bildungsraum Schweiz
Espace numérique suisse de formation
Spazio formativo digitale svizzero
Spazi da furmazium digital svizzer
Swiss digital education space

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Monitorage de l'éducation en Suisse
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Monitoring de la furmaziun en Svizra

Content

I. Management Summary	2
II. Objectives and key findings	5
II.I Mission and objectives of the report	7
II.II Conceptual framework	7
II.III Key findings	8
II.IV Development approaches and options for action	13

I. Management Summary

This report on “Digitisation in Education” summarises the existing knowledge on the state and the effects of digitisation in the Swiss education system and informs the wider reporting on education being conducted in Switzerland. The report was prepared by Educa,¹ on behalf of the two coordination committees of the federal and cantonal education cooperation process management.² It was compiled between January 2020 and May 2021 in close consultation with the General Secretariat of the EDK and the State Secretariat for Education, Research and Innovation (SERI).

The report provides two key insights. First, drawing on a review of existing international surveys on digitisation in education, it defines a conceptual framework outlining the information relevant for the monitoring of digitisation in education. Second, based on this conceptual framework, it brings together information from administrative data, statistics and research on the use of digital resources, their effects on teaching and learning as well as on the conditions for their successful application in the Swiss education system. This information is prepared, evaluated and processed in such a way that digitisation in the institutions of all education levels considered in this report (primary to upper secondary) can be described, explained and assessed against the evaluation criteria used by the Swiss education system (effectiveness, efficiency and equity).

The report is based exclusively on the analysis of scientific literature and secondary data. The informative value of these sources is critically examined.

The report’s empirical sections follow the structure and logic of the “Swiss Education Report” by the Swiss Coordination Centre for Research in Education (SCCRE).

The first chapter describes social and economic conditions that have a direct or indirect influence on digitisation in education. These include changes in skill demand on the labour market, patterns of use of digital media in the general population and the consequences of digital media use on the physical health and psychological well-being of children and adolescents.

1 Educa is the specialist agency of the Confederation and the cantons for the Swiss digital education space.

2 The process management for cooperation between the Confederation and the cantons in the field of education (de: “Prozessleitung Bildungszusammenarbeit (PL BiZ)”, fr: “Direction des processus de coopération dans l’espace suisse de formation (DP COF)”) maintains two coordination committees: (a) the coordination committee for digitisation in education (de: “Koordinationsausschuss Digitalisierung (KoA Digi)”, fr: “Comité de coordination Numérisation d’éducation (CC N)”) and (b) the coordination committee for education monitoring (de: “Koordinationsausschuss Bildungsmonitoring (KoA BiMo)”, fr: “Comité de coordination Monitoring de l’éducation (CC M)”).

The following chapter addresses topics that cannot be clearly assigned to a specific education level because they apply to more than one, or because of the complexity of the literature or limitations in the available data. These include questions on the contribution of digital resources to learning.

Information specific to each education level is then presented in the chapters that follow.

The final empirical chapter summarises existing knowledge on the effects of digital skills on life beyond the education system – on participation in the labour market and earnings, for example.

Drawing on the main findings of the report, possible development approaches are derived. These encompass possibilities to further improve the integration of digital technologies and resources in schools and teaching practices (area for action 1) as well as options to advance the monitoring of digitisation in education (area for action 2). These approaches either result directly from the empirical findings or arise from the comparison between the information that is actually available and the level of information on digitisation in education that should be available according to the model defined in the conceptual framework.

The report is primarily intended as a source of information for policy makers, administrators and members of the public interested in the field of education. For these stakeholders, it represents the first comprehensive overview of the current state of knowledge on digitisation in Swiss education. It also highlights the gaps and lacunae in this knowledge and aims to encourage the expansion of evidence-based decision-making in education to include issues concerning the deployment and use of digital resources for teaching, learning and school management.

II. Objectives and key findings

II.I	Mission and objectives of the report	7
II.II	Conceptual framework	7
II.III	Key findings	8
II.IV	Development approaches and options for action	13

This report on “Digitisation in Education” summarises existing knowledge on the extent and the effects of digitisation in education, focussing on the Swiss education system.

The report is a contribution of the specialist agency Educa to Switzerland’s reporting on education. It therefore follows the structure and logic of the “Swiss Education Report” by the Swiss Coordination Centre for Research in Education (SCCRE). The report proceeds sequentially: the first section draws on a review of existing international monitoring of digitisation in education in order to define the extent of digitisation in education relevant to the current report. It goes on to discuss the social and economic conditions that have a direct or indirect influence on digitisation in education and address issues that cannot be assigned to a specific stage of education, either because they apply to more than one or because of the complexity of the literature or limitations in the available data. This is followed by a consideration of information specific to individual levels of education. The benefits to the individual of digital skills beyond the education system, for example on incomes and consumer rents, are discussed in the ensuing segment on “cumulative effects”.

The information provided in the report is primarily descriptive in nature, i.e. it presents what can be said about the situation in the education system on the basis of the available data and the academic literature. It refrains from any normative evaluation of this situation.

II.I Mission and objectives of the report

As part of their cooperation in education, the Confederation (Federal Department of Economic Affairs, Education and Research, EAER) and the cantons (Swiss Conference of Cantonal Ministers of Education, EDK) deal with issues relating to the quality and permeability of the Swiss education system. For this purpose, they have set up the “Education Monitoring” and “Digitisation in Education” coordination committees. The specialist agency Educa was commissioned by these committees to prepare a report on “Digitisation in Education”. The objectives of this report are:

- 1) To provide an overview of the current extent of digital technologies and skills and their impact on the education system.
- 2) To identify missing information in research and statistics and thereby to highlight the gaps in the current monitoring of the education system.

The report was prepared in close consultation with the General Secretariat of the EDK and the State Secretariat for Education, Research and Innovation (SERI) between January 2020 and May 2021.

II.II Conceptual framework

Drawing on the academic literature and a review of the existing systems for monitoring digitisation in education across Europe, the report develops a conceptual framework. This framework defines the dimensions of digitisation in education that are relevant for the current report. It assumes that a modeltype monitoring of digitisation in education should provide information on three key issues:

- 1) **Describing digitisation:** monitoring should be able to describe the current level of integration of digital resources (i.e. technologies and content) in teaching and learning and school management. It should be able to describe how often, for what purpose and with what goals teachers integrate digital resources into their teaching practices.
- 2) **Explaining digitisation:** monitoring should be capable of illuminating and explaining current differences in the way teachers, institutions and educational systems use digital resources. This allows us to understand the extent to which characteristics and decisions at teacher, school and education authority level influence the use of digital resources for teaching and learning.

- 3) **Evaluating digitisation:** any monitoring of digitisation in education should be able to provide information about the added value for the individual and society of integrating digital resources into teaching and learning. In addition to general questions about the contribution of digital resources to the development of digital skills and the effectiveness of digital resources in teaching and learning, this also concerns the effects digital skills are expected to have outside the education system.

The conceptual framework is summarised in Figure 5 in the full version of the report (available in French and German). It draws to a considerable extent on existing frameworks used in national and international surveys.

II.III Key findings

Data resources and scientific literature

- With regard to the availability of information and data to describe, explain and evaluate digitisation, considerable differences exist between education levels, topics and individuals working in the Swiss education system. Particularly, substantial gaps exist in our knowledge of the state of digitisation (and its effects) in primary and upper secondary schools. Based on the existing data, only limited conclusions can be drawn about the state of digitisation in schools in Switzerland. This lack of information even affects our ability to provide comparatively simple statistics, such as the number of computers in primary schools, the distribution of specific learning resources or the budgets allocated for the acquisition and maintenance of digital resources.
- Studies on the effectiveness of digital resources for learning come almost exclusively from Asian countries and the English-speaking world, and the extent to which these findings can be applied to other education systems is far from clear. As a consequence, very little can be said about the about causal relationships between the use of digital teaching and learning resources and the academic performance of students in the Swiss education system. Moreover, there is a dearth of studies investigating the heterogeneity of the effect of digital learning resources on learning, even within the international literature.

- Available information on the digital skills of students and teachers stems almost exclusively from self-evaluations. This information is problematic because self-assessments differ from actual competencies. They therefore provide a highly distorted picture of the actual distribution of digital skills and introduce substantial bias in any analysis aiming to identify possible factors contributing to the formation of digital competence.

Describing digitisation

- The use of digital resources in teaching and learning has grown steadily in recent years. For example, the number of lower secondary school students who do not use the internet for school-related purposes on a normal weekday has almost halved between 2012 and 2018.
- Nevertheless, there remains a considerable proportion of students at all levels of education who never use digital devices at or for school. In 2020, this was the case for about 20% of students at all levels of education.
- The use of digital resources at and for school depends greatly on the student's age and educational level. It increases continuously from the primary to upper secondary school. At the same time, the motivation to work with digital devices decreases with increasing age.
- There are pronounced regional differences in the use of digital devices by students at school. At schools in German-speaking parts of Switzerland, digital devices tend to be used more frequently by students in class than in the French- and Italian-speaking parts of Switzerland. These differences by language region can also be observed within the bilingual cantons.
- Digital devices are often used as a means of supporting frontal teaching, for example for the presentation of lesson content. This form of use is particularly pronounced in French- and Italian-speaking parts of Switzerland.
- Digital devices and content are often used as a means of motivation and individual support for a priori under-performing students.

Explaining digitisation

- On average, access to digital devices in schools has improved in recent years. At the same time, differences between schools have become bigger.
- Schools in the French- und Italian-speaking parts of Switzerland tend to have less digital equipment per student than schools in the German-speaking regions.
- School principals tend to rate the digital skills of their teaching staff as satisfactory. However, according to data from the 2018 PISA survey, teachers in about a third of all lower secondary schools did not have the necessary technical and pedagogical skills to use digital devices in the classroom.
- In terms of digital school culture, Switzerland ranks slightly behind the other OECD countries. For example, although most lower secondary schools have a written policy on the use of digital devices, only about a third explicitly allow teachers time to develop, share and evaluate teaching materials and methods that use digital devices. This is significantly less than the OECD average.

Evaluating digitisation:

Effectiveness

- The use of digital resources can accelerate learning processes and improve learning. This is especially true if these resources support students in learning, practising or working on subjects independently.
- Where digital resources are used in the interaction between students and teachers, their effectiveness depends on whether and how traditional teaching methods are replaced or supplemented by digital resources. Digital resources that support teachers by enriching explanations with additional visualisations or practical examples, for instance, seem to have a positive effect on the learning performance of students. If, on the other hand, digital resources are used as a substitute for teachers, for example by outsourcing explanations and individual support to the computer or to a learning programme, the performance of students tends to deteriorate.

- Scientific assessments of the effectiveness of digital learning resources show that there are considerable differences in the quality of technically similar applications. Any evaluation of digital resources should therefore take place at the level of the individual application.
- Data collected in the Swiss education system tends to show a negative correlation between the frequency of use of digital resources and the academic performance of students. However, this is due at least in part to the fact that under-performing students are the more frequent users.
- At the same time, there are schools that deviate significantly from this trend. Their students use digital devices intensively in class and achieve high grades in standardized educational assessments. Why these schools deviate so clearly from the overall trend is a key question for future research.
- The results of international studies suggest that up to now, digital skills have mainly been acquired outside formal education.
- In Switzerland, self-assessed digital skills vary mainly between students. Observable differences in digital skills as well as in interest in working with ICT can be attributed overwhelmingly to individual differences between students rather than to structural differences between cantons or language regions.
- Unrestricted access to the internet at educational institutions often leads to intensive private use during lessons, in turn yielding a decrease in academic performance in the medium and long term.
- The international literature usually finds minor correlations between the access to digital equipment in schools, the teaching of digital skills in the classroom and the digital competence of students as measured on the basis of standardised tests.

Efficiency

- Due to a lack of studies on the effect of digital resources on learning and a dearth of reliable information on the expenditure on these resources by schools, communities and cantons, no conclusions can be drawn as to the efficiency of digital resources.

- International studies show that the cost-effectiveness of digital resources is primarily determined by their impact on learning. As returns on formal education tend to be substantial, improvements in learning through the use of digital resources are likely to yield increases in the net present value of average life-time incomes. These increases can be expected to largely exceed the initial expenditure on the acquisition and maintenance of digital resources, even if learning improvements are minimal.

Equity

- Access to digital devices in school is not an equity problem in the traditional sense. That is, it does not depend on the socio-economic composition of the student body.
- Access to digital resources in the home, on the other hand, shows clear socio-economic gradients. Households at the lower end of the income distribution scale are significantly less likely to have sufficient digital devices to provide every child in education with unrestricted access to such a device. This shortage of digital devices affects less than 4% of the most affluent households, but more than 20% of low-income families.
- There is little evidence that the availability and use of digital resources in the classroom affects different subgroups of the student population differently. One exception is age. Older learners tend to be more successful in using digital resources for learning.
- Compared to female students, male students show a significantly higher interest in digital technologies and a significantly higher motivation to use these technologies for learning. In addition, male students rate their competence in dealing with digital technologies significantly higher than female students. However, the results of standardised tests show that in many cases these differences in self-assessment are not reflected in measured performance. On the contrary, girls commonly outperform boys in standardised assessments of digital skills, especially when it comes to searching, processing and communicating information.
- The growing availability of online training courses has so far primarily benefited people who have completed tertiary education. This suggests that these training offers tend to amplify rather than level existing socio-economic gradients in education.

Cumulative effects

- Digital skills yield monetary and non-monetary benefits for individuals and the society in which they live.
- International studies place the wage premium of digital skills for employees at around 8%.

II.IV Development approaches and options for action

The report's key insights highlight a number of potential development approaches for advancing the integration of digital technologies and resources in classrooms and schools (area for action 1) as well as for improving the monitoring of digitisation in education (area for action 2). These approaches arise either directly from the statistical results or from the comparison of the monitoring of digitisation in education based on the model in the conceptual framework and the information actually available. They are presented in detail in chapter 10 of the full report (available in French and German).

Area for action 1: Provide targeted support for digitisation in education:

- a) Consolidate and develop the position of schools as central actors in the delivery of digital skills: Teaching digital skills in the framework of formal education is central to ensuring that all children and adolescents have the same opportunities to acquire these skills. In order to provide the most effective support for the teaching and learning of digital skills in public schools, the following conditions should be fulfilled:
 - i. Advance the already planned development of nationally valid frameworks for digital skills of the different groups of stakeholders of the education system (students, teachers, principals).
 - ii. Enable the standardised and nationally comparable assessment of digital skills across Switzerland.
 - iii. Improve the coordination between the various ongoing projects defining digital skills in different regions and for different school levels.

b) Evaluate and reinforce teacher education and training: The initial training and continuing professional development of teachers is key to the use of digital resources to add value to teaching and learning. In order to make better use of the existing heterogeneity in teacher education for the identification of best practices and a demand-driven development of teacher education programmes, information on the effect of the existing initial and further training programmes is indispensable:

i. Systematically evaluate the topic of digitisation in existing teacher training programmes.

ii. Systematically provide lecturers in teacher education and teachers with easy to understand summaries of the academic literature on the effects of digitisation.

c) Monitor and align the conditions for schools: In terms of the availability of digital devices as well as their “digital school culture”, there are large and growing differences between schools in Switzerland. To reverse this development, the following options for action should be considered:

i. Move forward with the definition of minimum equipment standards for schools.

ii. Allocate a time budget to teachers to allow them to develop, exchange and evaluate teaching methods using digital resources.

iii. Plan the implementation of digital resources on a long-term basis.

iv. Be aware of differences in availability of electronic equipment in households when implementing distance learning or BYOD approaches.

- d) Assess the effectiveness of digital learning resources at the level of the individual product: There are significant differences in the effectiveness of digital learning resources, even among technically very similar products. Any evaluation of the effectiveness of a learning technology should therefore be made at the level of the individual product. Towards this end, several options could be pursued:
- i. Introduce schemes which incentivise manufacturers to demonstrate the effectiveness of their products.
 - ii. Provide schools and teachers with tools to help them independently evaluate the effectiveness of digital learning resources.
 - iii. Link standardised student assessment data with technically recorded information on usage patterns of digital learning resources.
- e) Beware of digital media's potential to distract learners: As digital media can be highly engaging, providing unrestricted access to these media in educational settings has been shown to have a negative impact on learning. Mitigating these detrimental effects requires clear rules of use and, as a measure of last resort, access restrictions.

Area for action 2: Expand monitoring of digitisation in education

- a) Close information gaps: With regard to the availability of information and data to describe, explain and evaluate digitisation, considerable differences exist between education levels, topics and protagonists in the Swiss education system. In order to close these gaps and to complement the available data, several options can be explored:
- i. Enable a broader and more intensive use of existing data sets.
 - ii. Record, catalogue, standardise and provide access to existing administrative (municipal, cantonal and institutional) data.
 - iii. Participate in existing international surveys.
 - iv. Supplement existing national surveys.

- v. Launch stand-alone surveys dedicated to digitisation or expand and consolidate existing research projects.
 - vi. Establish and exploit “new” data sources.
- b) Promote research using data from the Swiss education system: There is a great deal of uncertainty concerning the causal relationships between school-based factors, the characteristics of teachers, the use of digital resources for learning and the academic performance of students. In order to obtain valid information on the impact of digital resources in the Swiss education system, increased efforts are needed to study these causal relationships (and their heterogeneity):
- i. Directly and indirectly promote research using Swiss data, i.e. through funding and by providing access to data enabling the analysis of causal effects.
 - ii. Evaluate on the basis of scientific standards the causal effects of digital learning resources currently introduced in schools.

The full report is available in French and German. It can be accessed via the following links:

French: <https://www.educa.ch/fr/themes/utilisation-des-donnees/rapport-la-numerisation-dans-leducation>
German: <https://www.educa.ch/de/themen/datennutzung/bericht-digitalisierung-der-bildung>

Acknowledgements

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Suggested source citation:
Educa (2021): Digitisation in
education, Educa, Bern.

Original title of the German version:
Educa (2021): Digitalisierung
in der Bildung, Educa, Bern.

Cover Picture:
Christin Hume (unsplash)

Corporate Design and Layout:
noord.ch

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August 2021