

White paper

# Online testing with remote proctoring

Benefits and challenges in a digitalised world



# Foreword

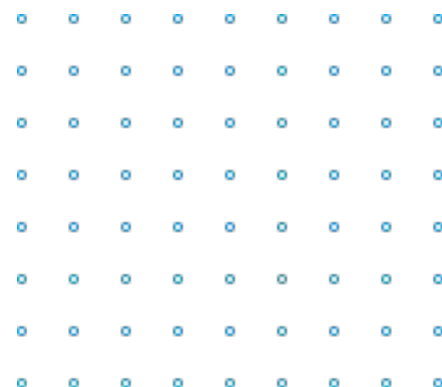
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The education sector has experienced extensive digitalisation in recent years. Market projections estimate global investment in new digital technologies in education to grow from \$18.6 billion in 2019 to \$350 billion in 2025.

The effect of the digitalisation of learning can also be seen in the surge in demand for online courses and online degree programmes. From 2011 to 2021, the number of students in open online courses increased from 300,000 to 220 million.<sup>1</sup> This trend is being responded to not only by private entities offering informal education, but also by universities starting to open online degree programmes.

As part of the digitalisation of learning, we are increasingly seeing the digitalisation of standardised testing, both in educational institutions and in the private sector. Standardised testing is one of the most accessible and objective tools for assessing competencies and, therefore, remains part of many admissions and certification processes. Digital (or online) tests are used in university or job admissions, in testing acquired knowledge and skills in knowledge and retraining courses, as well as in the continuous testing of students' or employees' competences.

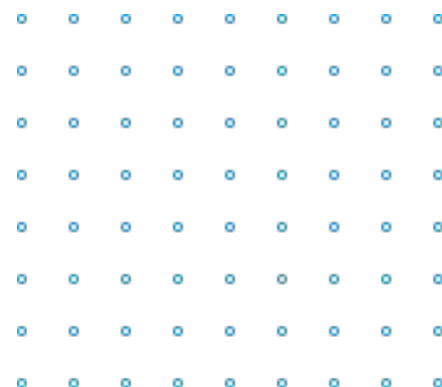
Digital testing brings **greater flexibility** – both for the test providers and the test takers. Compared to traditional tests organised in a physical environment, digital testing makes it possible to reduce the costs spent on exam preparation and administration. However, like innovations in other areas of education, online testing also raises **a number of questions**, for example regarding **data security, privacy protection, comparability of results, etc.**



Scio has been actively involved in standardised testing for over 25 years. Innovation in education related to digitalisation is therefore naturally one of our key topics. Thanks to the development of the SciLink platform, we successfully digitalised testing in Czech and Slovak universities during the Covid-19 pandemic and managed to test more than 100,000 applicants.

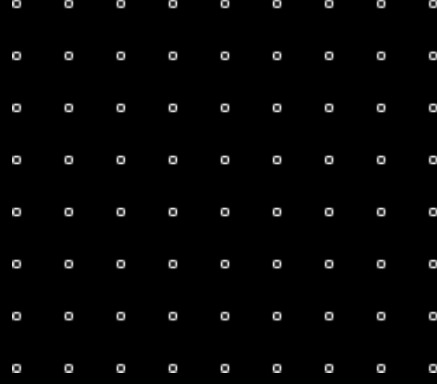
Together with our solution for online testing with remote proctoring, this document presents an analysis of the advantages and potential weaknesses of online testing in the context of market developments and stakeholder needs.

The first section of the document presents current trends in the digitalisation of education, the second section discusses the details of online testing with remote proctoring, and the third section addresses fundamental issues of online testing, such as the integrity of results, their comparability and data security. The last section provides recommendations for institutions starting with online testing.



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Section 1

# Digitalisation of education

Where we are in the digitalisation of education



# Where we are in the digitalisation of education

## Digital education is on the rise

The use of digital and online technologies in education is nothing new. Even before the Covid-19 pandemic, there was high market growth. Global investment in EdTech (educational technology) reached \$18.66 billion in 2019<sup>2</sup> and the total online education market is expected to reach \$350 billion by 2025.<sup>3</sup>

This trend increased even more due to the Covid-19 pandemic. The closure of schools in 2020 affected more than 1.2 billion pupils and students in more than 190 countries worldwide.<sup>4</sup> In the Czech Republic, almost 1.7 million pupils and students were affected by school closures.<sup>5</sup> As a result, the way education is delivered has changed dramatically: online learning has expanded significantly. The demand for online courses and online degree programmes has increased. For example, data from the Coursera online education platform shows a fourfold increase in individual enrolments in online education, a fivefold increase in employers providing online training and a ninefold increase in people studying online through government programmes in Q2 2020 alone.<sup>6</sup>

Educational and private institutions around the world and in the Czech Republic are now facing the challenge of adapting quickly to the digitalisation trend.

The Czech 2030+ education policy strategy includes an emphasis on digital education, both in terms of increasing the digital literacy of pupils and in terms of greater use of digital innovations that can make learning more effective.<sup>7</sup>

## Education providers, employers and government institutions are interested in being part of the digitalisation of education

The digitalisation of education can be seen in the academic, corporate and government spheres. Academic institutions offer purely online or hybrid degree programmes.<sup>8</sup> Companies provide online training to their employees. Governments are beginning to offer online retraining opportunities for at-risk jobs.<sup>9</sup> However, the extent to which digital solutions are being used varies in different spheres.

Formal educational institutions are more cautious in digitalising education. This may be due to concerns about the comparability of the quality of online and face-to-face solutions,<sup>10</sup> but also due to a more reluctant approach to innovation.

The private sector is investing more boldly in online education, addressing specific strategies to optimise the process rather than the issue of comparability of quality.<sup>11</sup>

Online training is crucial for companies in connection with employee retraining, where it proved particularly important during the Covid-19 pandemic.<sup>12</sup> The importance of retraining in the labour market is growing. Employers in many sectors face a growing **imbalance** between available and needed candidate qualifications. According to a report of the World Economic Forum (2020), up to half of employees will need to undergo some type of retraining by 2025. Up to 94% of employers expect their employees to learn new skills in the next three years (up from just 65% in 2018). The World Economic Forum report shows that 66% of companies surveyed expect to see a return on their investment in training their employees within one year. Companies' investment in employee retraining also has a significant social impact.

The lack of retraining opportunities could be reflected in growing inequalities due to economic crises or a persistent gap between demand and supply in the labour market. Moving employee training and retraining processes online can be a very beneficial solution for companies and employees, both in terms of speed and flexibility.

## Digitalisation of education does not solve all problems

The above may give the impression that the digitalisation of education and the transition to online systems is an entirely positive development. Digital technologies can certainly improve the process of learning and qualification if they are used to address relevant issues (for example, specific obstacles that have arisen as a result of the global pandemic). Appropriate conditions should also be set for their effective use.

Digitalisation of education therefore needs to be thought of in a broader context and in relation to specific situations. The following section compares different testing systems and describes in more detail the specifics of online testing solutions.



Section 2

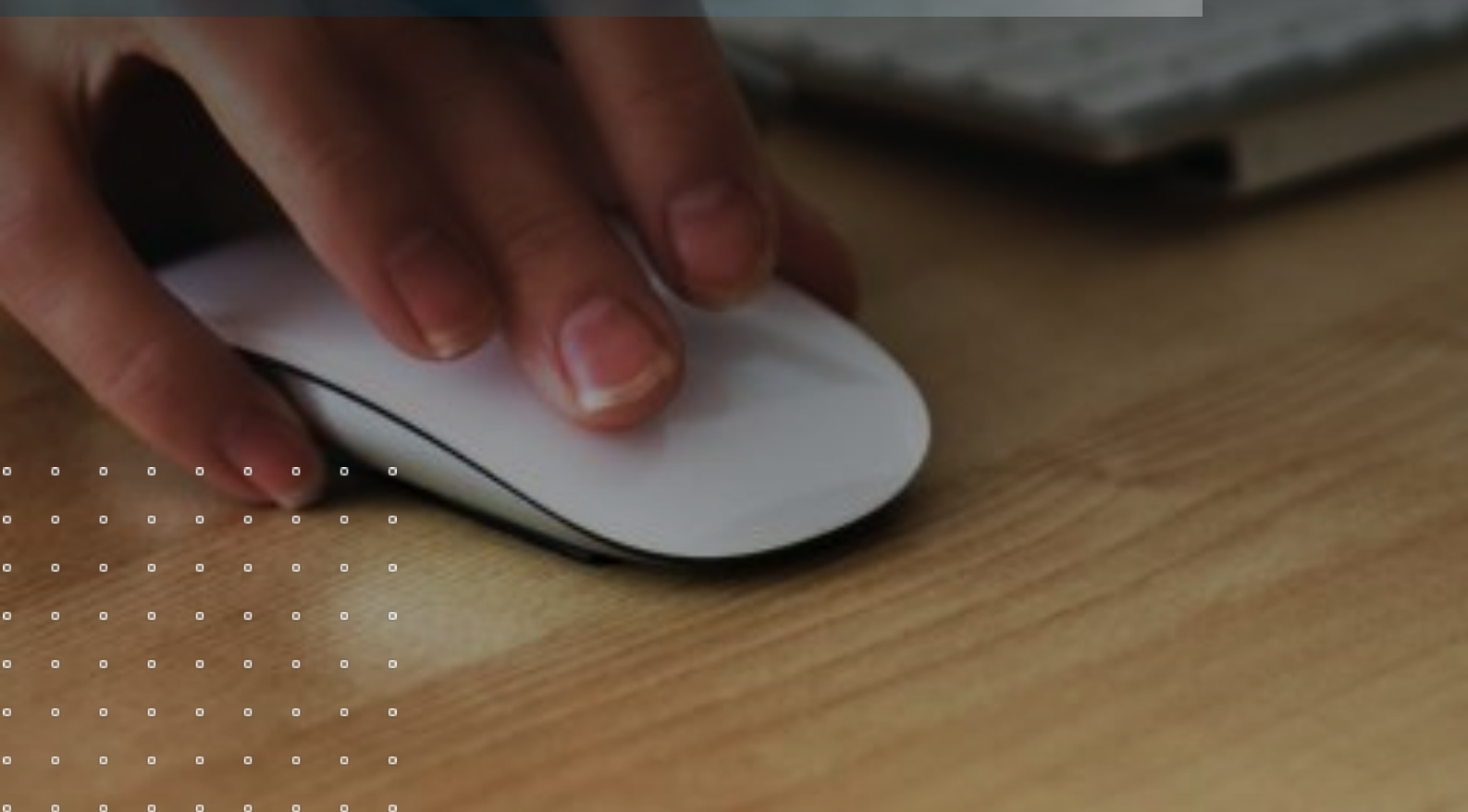
# Online testing

Knowing why you are testing

Comparison of testing systems

How online testing with proctoring works

Specifics of online testing with proctoring





# Knowing why you are testing

## You need to be clear about why you want to test

At the beginning of the test development, it is first necessary to specify what you want to test and why. The specification of the test fundamentally influences the specific form of the tasks. For testing to make sense, you need to say how you want to use the test results, i.e. why you are testing. You need to define the objectives of testing. These may be different – comparison of test takers, comparison of schools, testing of students' knowledge, determination of applicants' knowledge, etc. The objectives of testing determine the process of test construction, test scoring and the choice of the appropriate testing system.

Tests can be divided into **high-stakes tests** and **low-stakes tests**. The results of high-stakes tests have important consequences for the test takers. High-stakes tests include university admission tests, secondary school exit tests, job application tests, retraining tests, etc. In contrast, the results of low-stakes tests do not have such far-reaching consequences. These tests can often be taken repeatedly and serve more as feedback. They include continuous tests of the level of knowledge as part of learning which do not have a major impact on the final grade.

There are several types of tests, such as various performance tests, oral exams, etc. In Scio testing, we specialise in written tests, i.e. tests that are administered on paper or on a computer. In this document, we will therefore focus only on this type of test.

# Comparison of testing systems

Types of written tests can be divided into several categories, each bringing certain advantages and disadvantages:

## Face-to-face digital test

*A test taken on a computer or tablet at a test centre with live proctoring.*

- + Maximum controlled environment, online tasks, instant automated scoring
- Price, organisation, inflexibility, capacity

## Face-to-face paper-based test

*A traditional paper-based test taken in a dedicated test room with live proctoring.*

- + Maximum controlled environment
- Price, organisation, inflexibility, capacity

## Online test without proctoring

*A test taken online in the test taker's own environment without proctoring.*

- + Online tasks, instant automated scoring, flexibility, price
- Without proctoring integrity

## Online test with automated remote proctoring

*A test taken online in the test taker's own environment, first with an automated initial check of the recording, then for specific cases proctored by live evaluators.*

- + Degree of control, instant automated scoring, flexibility, easy organisation
- Need for additional check of specific recordings by evaluators, data collection and privacy protection

## Online test with live remote proctoring

*A test taken online in the test taker's own environment (e.g. at home) and proctored by examiners connected online.*

- + Degree of control, possibility of interaction and feedback, instant automated scoring, flexibility
- Limit of proctoring capacity and objectivity, organisation

## Online test with fully automated remote proctoring

*A test taken online in the test taker's own environment with fully automated recording control.*

- + Degree of control, instant automated scoring, flexibility, price, easy organisation
- Proctoring accuracy limit, no interaction between test taker and proctor, data collection and privacy protection

## Different types of testing are suitable for different occasions

Online tests offer a number of advantages over traditional face-to-face tests. They are **flexible, scalable and more cost-effective, and results are available faster.**

Conversely, the main advantage of face-to-face tests over online forms is the greater control over the environment in which the individual completes the test. In online tests, control of the environment is handled by different levels of security.

Different types of tests require different levels of protection. Specific measures need to be chosen according to the context and importance of the test (e.g. high-stakes vs low-stakes test). For example, if the content of a high-stakes test cannot be retrieved, organisers may opt for a simpler security protocol to minimise the likelihood of test takers being expelled for minor inadvertent infractions of the testing rules. Nevertheless, no measure provides a 100% guarantee of result integrity. For some types of tests, however, compromised result integrity is more serious than for others. Table 1 compares the aforementioned types of tests.

	Face-to-face test		Distance online test			
	Paper-based	Digital	Without proctoring	With live proctoring	With automated proctoring	With fully automated proctoring
Controlled environment	✓✓	✓✓		✓	✓	✓
Easy organisation			✓✓		✓✓	✓✓
Flexibility			✓✓	✓	✓✓	✓✓
Scalability			✓✓	✓	✓✓	✓✓
Cost-effectiveness			✓✓	✓	✓	✓✓
Online tasks		✓	✓	✓	✓	✓
Fast results		✓	✓	✓	✓	✓
Data collection	✓	✓		✓	✓✓	✓✓

Table 1: Comparison of test types

# How online testing with proctoring works

## Online proctoring allows taking high-stakes exams remotely

Online testing with remote proctoring allows taking tests remotely without the need to conduct face-to-face testing. It also ensures that testing is conducted properly and that test takers follow the rules, i.e. do not cheat.

Remote proctoring is carried out audiovisually, i.e. both audio and video output is monitored during testing. Remote online proctoring can be live or automated. In live proctoring, a human examiner takes part in the test, monitoring what is happening in the room and on the screen via the test taker's camera. In contrast, in automated proctoring, what is happening in the room and

on the screen is recorded and the recording is later processed using **several levels of control**.

First, the software automatically flags the places in the video that the AI believes do not follow the exam rules. For example, the number of people in the room is monitored, and speech, open door or unauthorised objects are detected. If the software detects a violation of the rules, that particular moment in the recording is flagged for the live evaluator. The live evaluator then checks all the flagged moments and decides according to predefined criteria whether a rule violation has actually occurred. We also use this type of proctoring in exams administered in SciOlink. The procedure is described in detail in Diagram 1.

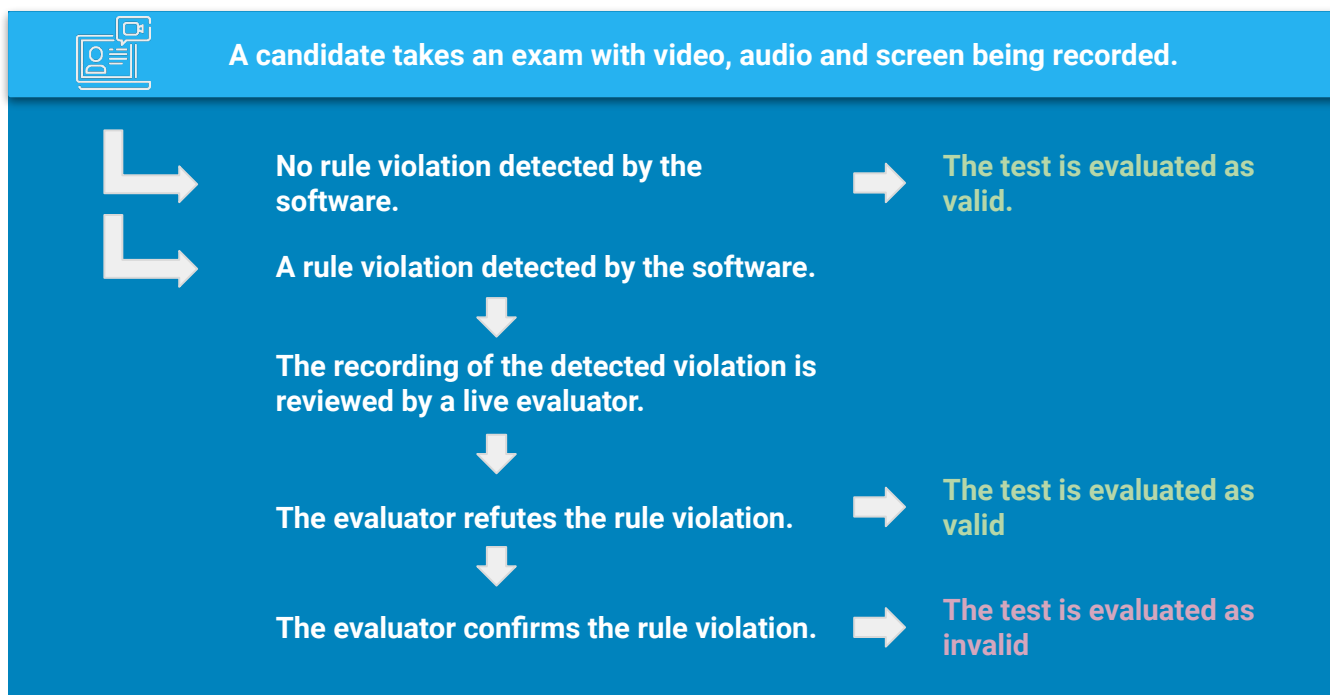


Diagram 1: Online testing process with automated proctoring

# Specifics of online testing with proctoring

The purpose and effect of online testing can be viewed from three perspectives, which should be combined when considering the content and form of the test:

1. information value of the results – provides information about test takers' abilities,
2. standardisation weight of the test requirements – sets the level of skills expected of a group of test takers,
3. wider societal effects – for example, making testing accessible to more groups of people.

## 1. Information value

### Online testing allows multiple different tasks to be used

The online testing format expands the range of possible task types that can be used in the tests. **Multimedia elements** such as audio recordings, videos or animations can easily be included in the test. It is also possible to use **interactive tasks**, such as drag and drop actions (where the user grabs an object, for example using the mouse, and drags it to another location on the screen).

However, not all content may be easily transferable from paper to screen. The online format may be less suitable for some types of content, such as working with longer texts without the possibility of highlighting or drawing.

Therefore, the format should be considered in relation to the features of the proctoring software when preparing the test and used appropriately.

**Automated scoring in online format increases result integrity, but the uniformity of test taker conditions is imperfect and it is desirable to prevent cheating**

The standardised form of testing guarantees a high degree of objectivity, but the reliability of the results also depends on the **process of completing the test** and **how it is scored**.

A highly controlled and uniform environment can be achieved in a face-to-face exam where the possibility for participants to break the rules and cheat is limited. However, in the online form of the test, the conditions of the individual test takers will not always be completely identical, so the question arises to what extent the completion process can be controlled to guarantee result integrity. More on this topic and the possibility to prevent cheating in online tests is presented in the chapter "Integrity and comparability".

The online form of testing allows the use of automated scoring, which, compared to scoring in traditional testing, is resistant to human error on the part of the evaluator and to indistinct markings in the record sheet, which may be difficult to read by machine.

## 2. Standardisation of the ability to work in a digital environment

**Online testing confirms the value of the institution's ability to modernise and be flexible; in relation to test takers, it signals the requirement to be able to work in a digital environment**

By providing online testing, the institution is signalling its ability to implement modern solutions and its willingness to accommodate test takers with its flexibility. In addition, the online form places an additional requirement on test takers: the ability and willingness to work in a digital environment.

Some institutions perceive this requirement as desirable (for example, the vice-dean of the Jessenius Faculty of Medicine at Comenius University in Martin believes online testing should test not only knowledge but also technological competences of applicants).<sup>13</sup>

However, given that access to technology and the internet is out of reach for certain sections of society, the question of the fairness of this requirement arises (for a more detailed insight into this issue, see the chapter "Equality of opportunity and access to education").

## 3. Social impacts

**Online testing is accessible to more groups of people**

With its flexibility, online testing can be one of the tools that make education or applying for a job more accessible to applicants from abroad, working people, parents with young children or people in a restrictive living situation. On the other hand, if it is without a face-to-face alternative, it may not be accessible to social groups that do not have the necessary technology or the appropriate environment (for a more detailed insight into the issue of inequality and online testing, see the chapter "Equality of opportunity and access to education").

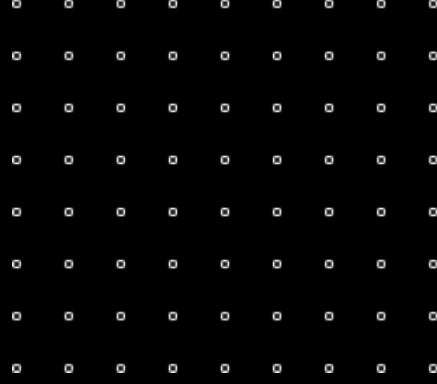


Section 2

# The burning questions in online testing

**Integrity and comparability**

**Data collection and privacy protection**



# Integrity and comparability

## Online testing often raises concerns about the integrity of results and their comparability with face-to-face testing.

For online forms of testing, the question arises whether it is adequately comparable to traditional testing, especially in the completion process and in result integrity. The environment for online testing (1) is never completely uniform, which may reduce the level of standardisation, and (2) is not completely controlled, which may create opportunities for cheating and call into question the integrity of the results.

Uniformity of the online exam environment can be achieved by clearly communicating the exam rules and by monitoring compliance. In a completely unproctored test, the test takers have a greater opportunity for cheating than in a proctored, face-to-face exam – and indeed, according to a meta-analysis of result comparability, test takers' performance on an unproctored online exam is significantly better than on a traditional face-to-face exam.<sup>14</sup> However, when security features are included in the online exam, the difference between the two types of testing is evened out.

## Result integrity can be improved by combining several different measures depending on the needs of the test:

### PREVENTIVE SAFETY FEATURES

Information about the effects of cheating, statutory statements that the test taker must acknowledge before the test, and notification of the possibility of an additional control test have no observable effect without remote proctoring, according to the literature.<sup>15</sup> By far the most reliable preventive measure of result integrity is the very **content of the test** – variation in performance in the transition to online testing will be minimal if the test requires complex critical thinking and if answers cannot be easily retrieved.

### LIMITING SAFETY FEATURES

**Limiting tools** can include a time limit combined with the requirement to complete the test by all test takers simultaneously. It is also possible to restrict access to certain applications or actions (for example, copy and paste).

### OBSERVATIONAL SAFETY FEATURES

**Observational tools** can track connected devices or unauthorised activity on the computer, or analyse mouse movements or keystrokes. **Audiovisual proctoring** checks the uniformity of the environment during testing, as well as the test takers' identity and behaviour. **Result evaluation** may flag suspicious patterns (for example, groups of identical answers or suspicious improvements).

# Data collection and privacy protection

Online testing with remote proctoring works with very sensitive data, such as personal data, video footage of test takers in their homes, and screen and keyboard activity. Legal regulation of such situations may vary in different legal systems, but when processing of personal data takes place, it should be ensured that it is as ethically sound as possible and that the test takers' privacy is protected.

## Basic data protection rules

The protection of privacy, data and intellectual property can be handled in different ways, depending on the legal environment. However, there are a few principles that should be followed in online solutions:

### Protection of test content and intellectual property:

- test development and administration is conducted in a secure environment,
- access to the content is restricted to authenticated persons only,
- any copyright infringement is monitored and reported, even for outdated versions of the content.

### Protection of test taker data:

- only the most necessary data about the test takers are collected,
- storage and transmission of data are secured against loss, damage, leakage and theft,
- access to test taker data is restricted to authenticated persons only,
- staff are trained to handle data responsibly,
- data are not misused and the purpose of data collection is legitimate and clearly stated,
- data are kept only for a limited period of time,
- communication to the test taker about their rights and data collection is clear and transparent,
- data collection does not take place without consent.

# Equality of opportunity and access to education

Digital solutions in education, testing and certification can make learning, qualifications or admissions more accessible to more groups of people, including disadvantaged people. Similarly, online testing can play an important role in increasing access to education.

However, digital solutions are not a panacea in this regard – it also depends on the content of the course or test itself and the support available to participants. Tests in general can disadvantage certain groups of test takers, for example directly in the test questions. It can influence education policy in a way that replicates existing inequalities. For example, online courses show that the MOOC (massive open online course) format is much more likely to be chosen and completed by participants who already have one university degree than by participants with no prior higher education experience.<sup>16</sup>

Making a test or certification available through an online format to some groups of people may also put others at a disadvantage, for example those who are not used to the digital environment or do not have the necessary technology.

It is therefore necessary to consider which groups of people the online form of the test is intended to reach and to know their specific conditions.

For some social groups, for example, a stable connection or their own computer with a webcam may still be an unattainable luxury.

In a number of such cases, however, the face-to-face alternative does not make the test any more accessible. Conversely, in other cases – for example, a compulsory exam or a major high-stakes test – the exam without a face-to-face option and without offering to lend the necessary equipment or provide facilities would be unfair to people who do not have access to the necessary equipment.

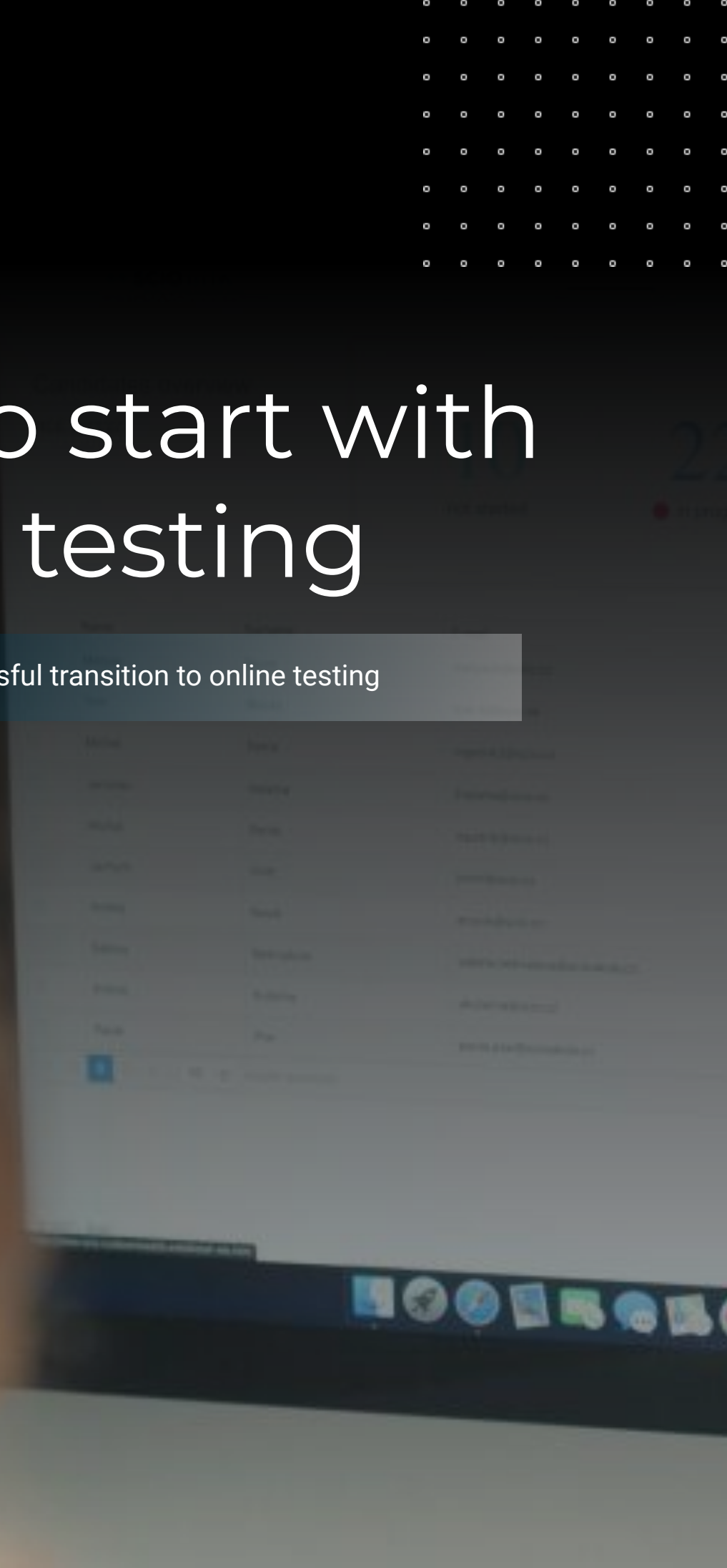
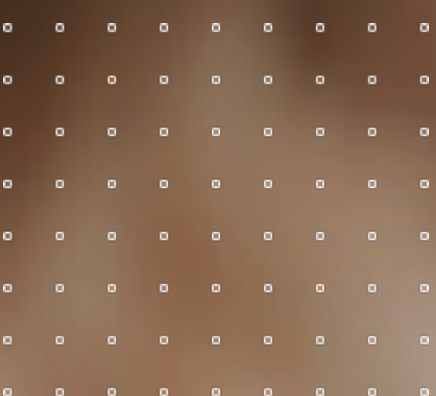
According to the latest data from the World Economic Forum, the degree of electronic equipment usage has been on the rise globally, but with continuing regional and income disparities (the global average for electronic equipment is 60%, in sub-Saharan Africa only 30%, in Latin America and the Caribbean 73%, in Europe and Central Asia 80%, in North America 90%; in the population with high income 90%, with upper middle income 73%, with middle income 57%, with lower income 21%).<sup>17</sup>

In the Czech context, the PAQ and IDEA think tank recorded a 50% improvement in the equipment of pupils for online learning in just six months of the Covid-19 pandemic. The equipment ratio of children of parents with a university degree to those without a higher education remains 2:1, although the number of unequipped pupils has fallen in both groups.<sup>18</sup>

Section 3

# How to start with online testing

Conditions for a successful transition to online testing



# Conditions for a successful transition to online testing

Online testing brings many advantages. New technology has the potential to bring many improvements if it is used as a tool to solve relevant problems and if there are the right conditions for its effective use. However, implementing new technology purely out of pressure to “follow the trend” can result in a significant investment without demonstrable positive impact. If it is in the institution’s interest to implement online testing, it is necessary to create the **appropriate conditions** for the adoption of the new technology and to follow a **predetermined plan**.

## Conditions for adoption of new technology – test type

Different test types require different solutions. For example, the degree of assurance of result integrity will vary depending on what decision the test score is used for. High-stakes tests will require a higher degree of security against cheating or otherwise misleading results than medium and low-stakes tests. The form of the test may also determine the degree of compatibility with the online format, which includes tools for a wide range of exams (for example, online tests were developed as early as the 1990s to test musical, medical or social skills<sup>19</sup>), but is less suitable for some types of tasks (for example, for working with long texts or for drawing tasks).

## Institutional conditions

According to a recent McKinsey study<sup>20</sup>, the following institutions have a higher success rate in adopting new technology in education and testing:

1. institutions where there is consensus on the goals of the new technology (statistically more successful institutions are those where all stakeholders are acquainted with the motivation for moving to digital or online solutions),
2. institutions that have taken into account the availability and affordability of technology,
3. institutions investing in support structures, such as providing the necessary hardware and software, as well as training and education on the technology,
4. institutions that agreed to measure success before implementing the new software, and implemented such measuring.

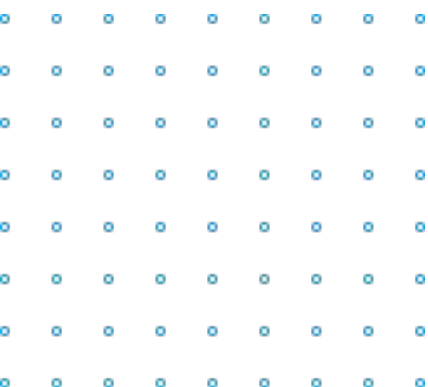


## How to start?

Therefore, for the implementation of an online testing solution (with or without proctoring) to be successful, the organisation needs to proceed in a strategic way.

We recommend the following steps:

- 1 conducting an initial analysis of specific needs, current status and capacities,
- 2 creating a clear project plan that includes:
  - definition of the size and results of the project,
  - definition of the tasks and timeframe of the project,
  - definition of roles and responsibilities,
- 3 training of stakeholders (target users, administrators, managers, etc.),
- 4 clear communication about the project, i.e. explaining what is happening, when, why, and creating space for feedback,
- 5 regular measurement of success and evaluation of the project leading to further changes.



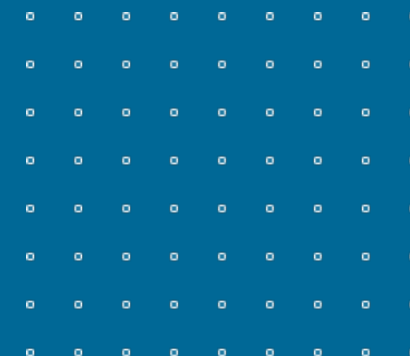


## Conclusion

Demand for online education (including testing and certification) has been on the rise for a long time and this trend can be expected to continue. Online standardised testing solutions make admissions and certifications accessible to candidates with individual time or mobility constraints. For institutions, it brings flexibility by being independent of certain external circumstances (e.g. space or staff capacity) and saving time and resources spent on the preparation and organisation of testing. With appropriate security measures in place, full comparability between face-to-face and online exams can be achieved.

The transition to digital testing is certainly not easy. If organisations decide to implement it, they need to make an informed decision after considering the institution's conditions, the demands of the test and the potential risks.

However, if organisations make the transition to online testing strategically, online testing can save them resources, increase their attractiveness to candidates or test takers, increase their flexibility and modernise their organisation overall.





Scio has developed an online tool for digital testing – SciOLink. SciOLink is a secure **online tool** for administering exams and tests with remote proctoring, effectively providing:



**Test  
creation**



**Test  
administration**



**Remote  
proctoring**

## SCIOLINK IS NOW USED BY CZECH AND SLOVAK FACULTIES FOR ADMISSIONS:

**Significant**

saving of time for the administration of exams, thus also a reduction in the financial costs of admissions procedures

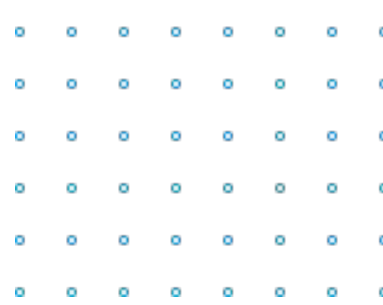
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faculties of universities in the Czech Republic and Slovakia have conducted their entrance exams for thousands of candidates via the SciOLink application

**40,000**

online exams conducted via SciOLink – this includes both faculty exams and Scio's National Comparative Exams

## ScioLink's main features:



### Testing

- Use of different types of tasks with the possibility of using audio and video content.

### Ensuring validity

- Identification of the examinee by identity card.
- Recording video, audio, desktop and running processes on the computer.
- AI technology to detect cheating.
- Records reviewed by trained human evaluators.
- Video recordings of each testing kept for at least 1 month for review if necessary.

### Security and privacy

- Technologically secure Microsoft Azure solution for data processing and storage.
- Consistent internal records access policy to prevent data leakage due to human error.
- Volume of collected data and records reduced to the minimum necessary.

### Accessibility

- Application scalability allowing 100 to 10,000 simultaneous tests.
- Offline mode ensuring that the test is not interrupted in the event of an outage.
- Multilingual support providing assistance to test takers from different locations.
- Onboarding before the exam to prepare examinees for the technical specifications and assure them that the process is correct.

**For more information contact**

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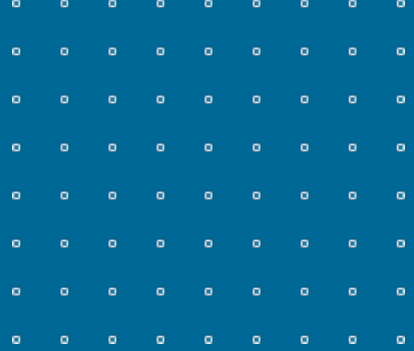
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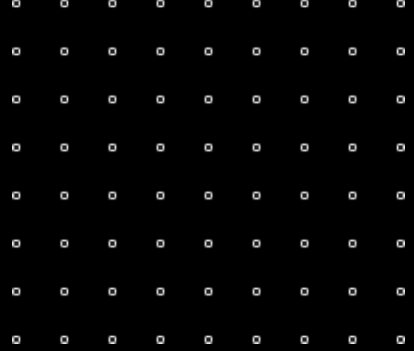
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