



CResDET



Co-funded by the  
Erasmus+ Programme  
of the European Union

Erasmus+ Project Crisis-Resistant Digital Education and Training

---

# Erasmus + Project: Crisis Resistant Digital Education and Training

## Intellectual Output 1 – Activity 5 Crisis Scenarios in Higher Education





*CResDET*



Co-funded by the  
Erasmus+ Programme  
of the European Union

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

---

## **DISCLAIMER**

"The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein."



## OVERVIEW

1. Characterization of crisis-related conditions .....	3
2. Review of previous and current crisis.....	14
3. Outlook on future crisis scenarios.....	28
3.1. Outlook 1: Covid-19 crisis ends.....	28
3.2. Outlook 2: New variants with seasonal effects .....	28
3.3. Outlook 3: Worsening Covid-19 crisis.....	28



Every crisis brings with it a set of limitations for the affected population. The limitations can vary in intensity and duration. Moreover, a crisis often occurs unexpectedly, demanding a rapid adaptation to the new conditions. The global Covid-19 pandemic demonstrated how vulnerable the higher education sector is when confronted with a crisis.

This section of the framework encompasses three main objectives. In Part D a list of generic crisis conditions in varying intensities with their impact on educational activities has been established. On the basis of these generic crisis conditions the Covid-19 pandemic, as well as previous and potential future crises have been evaluated (Part E). Finally, three outlooks of the possible future development of the Covid-19 pandemic and their implications are given (Part F).

## 1. CHARACTERIZATION OF CRISIS-RELATED CONDITIONS

Objective: Identification of restrictions that can become effective in the event of a crisis.

### 1.1. GENERAL CONDITIONS

#### MOVEMENT

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Freedom of movement</b>			
Free movement	There are no restrictions on freedom of movement.	No impact.	Physical, Hybrid, Completely Online
Restriction of international movement	International movement is restricted. <i>E.g.: Leaving the country is only possible with restrictions, such as returning to the country of origin.</i>	Educational activities that require international movement are only possible with restrictions. If these restrictions cannot be met in an appropriate manner, education needs to take place on a national or digital level.	Physical, Hybrid, Completely Online
Prohibition	International	Educational activities that require	Physical,

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

of international movement	movement is prohibited. <i>E.g.: Leaving the country is forbidden.</i>	international movement are not possible. Education needs to take place on a national or digital level.	Hybrid, Completely Online
Restriction of national movement	National movement is restricted. <i>E.g.: Leaving the region is only possible with restrictions, such as returning to the place of residence.</i>	Educational activities that require national movement are only possible with restrictions. If these restrictions cannot be met in an appropriate manner, education needs to take place on a local or digital level.	Physical, Hybrid, Completely Online
Prohibition of national movement	National movement is prohibited. <i>E.g.: Leaving the region is forbidden.</i>	Educational activities that require national movement are not possible. Education needs to take place on a local or digital level.	Hybrid, Completely Online
Prohibition of movement	Any non-essential movement is prohibited. <i>E.g.: Leaving the residence is forbidden.</i>	Educational activities that require movement are not possible. Education needs to take place digitally.	Completely Online

**POWER**

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Availability</b>			

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

No issues	There are no problems with the power supply.	No impact.	Physical, Hybrid, Completely Online
Temporary shortages or outages	There are brief power shortages or outages. <i>E.g.: Short interruptions.</i>	If the power failures cannot be intercepted by technical systems (e.g. generators), educational activities that require electricity must be timed accordingly. If this is not possible, analog substitutes need to be used.	Physical, Hybrid, Completely Online
General shortages or outages	There are longer lasting power shortages or outages. <i>E.g.: No power over several hours or days.</i>	If the power failures cannot be intercepted by technical systems (e.g. generators), educational activities that require electricity must be timed accordingly. If this is not possible, analog substitutes need to be used.	Physical, Hybrid
Complete power loss	The power supply breaks down over a long period of time. <i>E.g.: No power over weeks or months.</i>	If the power failures cannot be intercepted by technical systems (e.g. generators), educational activities that require electricity must be substituted with analog media and content.	Physical

**CONNECTIVITY**

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Telephone connection</b>			
No issues	There are no problems with the telephone connection.	No impact.	Physical, Hybrid, Completely Online

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

Bad connection	The telephone connection is bad or has sporadic failures.  <i>E.g.: Short interruptions.</i>	Educational activities that require a telephone connection must be timed accordingly. If this is not possible, analog substitutes need to be used.	Physical, Hybrid, Completely Online
Temporary breakdowns	The telephone connection fails for a short period of time.  <i>E.g.: No telephone connection over several hours or days.</i>	Educational activities that require a telephone connection must be timed accordingly. If this is not possible, analog substitutes need to be used.	Physical, Hybrid, Completely Online
Complete breakdown	The telephone connection fails for a long period of time.  <i>E.g.: No telephone connection over weeks or months.</i>	Educational activities need to be substituted with digital or postal service.	Physical, Hybrid, Completely Online
<b>Internet connection</b>			
No issues	There are no problems with the internet connection.	No impact.	Physical, Hybrid, Completely Online
Slow connection	The internet connection is slow or has sporadic failures.  <i>E.g.: Short interruptions.</i>	Educational activities that require internet connection must be timed accordingly. If this is not possible, analog substitutes need to be used.	Physical, Hybrid, Completely Online
Temporary breakdowns	The internet connection fails for a short period of	Educational activities that require internet connection must be timed accordingly. If this is not possible,	Physical, Hybrid, Completely



	time. <i>E.g.: No internet connection over several hours or days.</i>	analog substitutes need to be used.	Online
Complete breakdown	The internet connection fails for a long period of time. <i>E.g.: No internet connection over weeks or months.</i>	Educational activities need to be substituted with phone or postal service.	Physical

## 1.2. HIGHER EDUCATION-RELATED CONDITIONS

### INSTITUTIONAL INFRASTRUCTURE

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Physical access</b>			
Full access	There are no limitations regarding the physical access to the institution or its resources.	No impact.	Physical, Hybrid, Completely Online
Partial access	The institution and its resources are only partly accessible physically. <i>E.g.: Access only at specific times or for specific personnel.</i>	If educational activities require offline activities at the institution, they can only take place to a limited extent. Lessons must be adjusted according to the restrictions in place. If this is not possible, online lessons must be used.	Physical, Hybrid, Completely Online



**Erasmus+ Project Crisis-Resistant Digital Education and Training**

No access	The institution and its resources are not accessible physically.	Educational activities need to be substituted by online resources.	Completely Online
<b>Online access</b>			
Full access	There are no limitations regarding the access to online services of the institution.	No impact.	Physical, Hybrid, Completely Online
Partial access	The institution and its resources are only partly accessible online. <i>E.g.: Access only at specific times or for specific personnel.</i>	If educational activities require online resources of the institution that are affected by restrictions, they can only take place to a limited extent. Lessons must be adjusted according to the restrictions in place. If this is not possible, an offline replacement is required.	Physical, Hybrid
No access	The institution and its resources are not accessible online.	Educational activities need to be substituted by offline resources.	Physical

**LEARNING RESOURCES**

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Physical availability</b>			
Fully available	There are no limitations regarding the physical availability of learning resources.	No impact.	Physical, Hybrid, Completely Online

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

Partially available	The learning resources are only partly available physically. <i>E.g.: Only specific material is available.</i>	Educators need to create the missing physical learning resources or substitute them with online resources.	Hybrid, Completely Online
Not available	The learning resources are not accessible physically.	Educators need to create physical learning resources or substitute them with online resources.	Completely Online
<b>Online availability</b>			
Fully available	There are no limitations regarding the online availability of learning resources.	No impact.	Physical, Hybrid, Completely Online
Partially available	The learning resources are only partly available online. <i>E.g.: Only specific material is available.</i>	Educators need to create the missing online learning resources or substitute them with physical resources.	Physical, Hybrid
Not available	The learning resources are not accessible online.	Educators need to create online learning resources or substitute them with physical resources.	Physical
<b>Physical access</b>			
Full access	There are no limitations regarding the physical access to the learning resources.	No impact.	Physical, Hybrid, Completely Online

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

Partial access	The learning resources are only partly accessible physically. <i>E.g.: Only specific material is available.</i>	Educators need to ensure access to the missing physical learning resources or substitute them with online resources.	Hybrid, Completely Online
No access	The learning resources are not accessible physically.	Educators need to make the learning resources available physically or substitute them with online learning resources.	Completely Online
<b>Online access</b>			
Full access	There are no limitations regarding the online access to the learning resources.	No impact.	Physical, Hybrid, Completely Online
Partial access	The institution and its resources are only partly accessible online. <i>E.g.: Only specific material is available.</i>	Educators need to ensure access to the missing online learning resources or substitute them with physical resources.	Physical, Hybrid
No access	The learning resources are not accessible online.	Educators need to make the learning resources available online or substitute them with physical learning resources.	Physical

**PERSONNEL**

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Availability</b>			
Fully available	There are no limitations regarding the availability of educators.	No impact.	Physical, Hybrid, Completely Online
Partially available	Educators are only partly available. <i>E.g. Only specific persons or only during specific times.</i>	Missing educators have to be replaced, or the course content has to be adapted to their availability. If this is not possible, the course content must be changed to free learning.	Physical, Hybrid, Completely Online
Not available	Educators are not available.	Missing educators have to be replaced, or the course content has to be converted to free learning.	Completely Online



### 1.3. PERSONAL CONDITIONS

Please be aware that there are a variety of personal restrictions that can affect the ability to participate in education and training (e.g. motivation, personal capacity, etc.). Most of these factors are person-specific and vary among different educators and students. This project is focused on methodologies and tools for a crisis-resistant education and training. Therefore, person-specific psychological aspects that influence education are not considered. Rather, the focus is on finding the appropriate methodologies and tools to react to different crisis scenarios.

#### EQUIPMENT

Condition	Description	Impact and consequences	Recommended level of digitalisation
<b>Availability</b>			
Fully available	The equipment required for educational activities is fully available.	No impact.	Physical, Hybrid, Completely Online
Partially available	The equipment required for educational activities is partly available. <i>E.g.: Students possess a phone but no laptop.</i>	If possible, suitable equipment needs to be purchased. If this is not feasible, the learning content needs to be adapted to meet the available equipment.	Physical, Hybrid, Completely Online
Not available	The equipment required for educational activities is not available.	If possible, suitable equipment needs to be purchased. If this is not feasible, the learning content needs to be adapted to meet the available equipment.	Physical
<b>Suitability</b>			
Fully usable	The available equipment is suited for the intended educational	No impact.	Physical, Hybrid, Completely Online



	activities.		
Partial usable	<p>The available equipment is only partly suited for the intended educational activities.</p> <p><i>E.g.: Phones can be used for writing an essay, nevertheless a laptop would be better suited.</i></p>	If possible, suitable equipment needs to be purchased. If this is not feasible, the learning content needs to be adapted to meet the available equipment.	Physical, Hybrid, Completely Online
Not usable or not existing	The available equipment is not suited for the intended educational activities.	If possible, suitable equipment needs to be purchased. If this is not feasible, the learning content needs to be adapted to meet the available equipment.	Physical



## 2. REVIEW OF PREVIOUS AND CURRENT CRISIS

**Objective:** Analysis of different examples of current and past crises with regard to the conditions imposed on educational activities in engineering design.

### 2.1. COVID-19 PANDEMIC

The infectious Coronavirus disease SARS-CoV-2 caused a worldwide pandemic crisis. Higher education institutions around the world were sent into lockdown by their respective governments to minimise the spread of the disease. Depending on case numbers and severity of the lockdown measures, different restrictions were put in place.

The following descriptions reflect on the general conditions at the four partner institutions. As can be seen, different restrictions affected the movement, the access to the institution and the availability of learning resources. An in-depth analysis on the Covid-19 crisis from the educators' perspective and its effects on design education is part of a wider survey that is not part of this review.

#### 2.1.1. TU WIEN

<b>Movement</b>	<b>Geographic limitations</b>	In the course of the crisis, the movement of educators and students was severely restricted. Especially at the beginning of the crisis, travel was only possible to a very limited extent within the country. Therefore, all design education-related activities were substituted with online activities. Despite increasing relaxation, the design education-related activities continued to be taught online wherever possible.
	<b>Requirement-based limitations</b>	Despite constantly changing requirements, the restrictions remained minor. In most cases, it was enough to wear a mask and have a negative COVID test.
<b>Power</b>	<b>Availability</b>	There were no problems with the power supply.
<b>Connectivity</b>	<b>Telephone connection</b>	There were no problems with the telephone connection on a general level.
	<b>Internet connection</b>	There were no problems with the internet connection on a general level.
<b>Institution</b>	<b>Physical</b>	At the beginning of the crisis, access was only allowed for key personnel. After a while, access was granted to part of



	<b>access</b>	the workforce, when they fulfilled certain criteria ( <i>see requirement-based limitations</i> ). In addition, access for students for exams was allowed if they fulfilled the same requirements.
	<b>Online access</b>	There are no limitations regarding the online access to the institution or its resources.
<b>Learning resources</b>	<b>Physical availability</b>	Due to the nature of the crisis, all physical learning resources have been replaced with online learning resources.
	<b>Online availability</b>	At the beginning of the crisis, online learning resources were only partially available. Therefore, all missing resources were created at the beginning of the crisis.
	<b>Physical access</b>	Due to the nature of the crisis, all physical learning resources have been replaced with online learning resources. Therefore, physical access was not considered or available.
	<b>Online access</b>	Online access to educational materials was possible without any restrictions as soon as it was created ( <i>see physical availability</i> ).
<b>Personnel</b>	<b>Availability</b>	Fortunately, there were no limitations regarding the educators' availability during the crisis.
<b>Equipment</b>	<b>Availability</b>	All that was needed for online lessons was a laptop with internet access. This was the case with most of the students. If a student did not have the appropriate equipment, an individual solution was sought. In individual cases, this could mean postponing individual activities until the end of the restrictive lockdown. The provision of replacement devices for all students was not possible due to the large number of students and the limited budget resources.
	<b>Suitability</b>	In some cases, engineering design programs have demanding requirements that older laptops cannot meet. To counteract this problem, all resource-intensive calculations were carried out on performant TU-internal servers and only the results were streamed to the user via GUI.



**2.1.2. UNIVERSITY OF LJUBLJANA**

<b>Movement</b>	<b>Geographic limitations</b>	During the crisis, the movement of teachers and students was severely restricted. At the beginning of the crisis, the number of students in the faculty was limited by the size of the space (hybrid mode of study). With the aggravation of the situation, the restrictions of the movement were first on the regions, later on the municipalities. The study was conducted exclusively online. All other activities also took place via the Internet
	<b>Requirement-based limitations</b>	It was necessary to follow the recommendations of the National Institute of Public Health (distance between persons, wearing masks, disinfection,...)
<b>Power</b>	<b>Availability</b>	There were no restrictions.
<b>Connectivity</b>	<b>Telephone connection</b>	In general, there were no restrictions on telephone connections. The problems are bilie in places that are poorly covered by the mobile signal.
	<b>Internet connection</b>	In general, there were no restrictions with the internet connection. The problems were in places where there is no possibility of connecting to a broadband network, or in places that are not covered by 4G or 5G signal.
<b>Institution</b>	<b>Physical access</b>	First a restriction on the number of people according to the size of the lecture halls (hybrid mode), then a complete ban on the physical presence of students. In the last part, physical access is possible again, but subject to restrictions.
	<b>Online access</b>	There were no restrictions.
<b>Learning resources</b>	<b>Physical availability</b>	Access to libraries and physical resources is initially restricted, later disabled. Switch to online resources.
	<b>Online availability</b>	Online learning resources were available, but were initially lacking and were constantly being upgraded.
	<b>Physical access</b>	Restricted / disabled



	<b>Online access</b>	Online access was enabled, but limited to individual target groups.
<b>Personnel</b>	<b>Availability</b>	Available via online systems (e-mail, calls, meetings, ...)
<b>Equipment</b>	<b>Availability</b>	Equipment for the online study was available to staff. The students had to provide the appropriate equipment (computer) themselves. Research equipment was available to staff, not to students.
	<b>Suitability</b>	For the most part, the equipment was adequate. In case of inadequate equipment, students were given remote access to faculty computers.

### 2.1.3. UNIVERSITY OF ZAGREB

<b>Movement</b>	<b>Geographic limitations</b>	As in other locations, the movement of educators and students was severely restricted. Educators and students from different locations were not allowed to travel, and they were forced to immediately switch to online education practices. For that reason, the whole institution transitioned to online teaching and learning.
	<b>Requirement-based limitations</b>	The institution had to follow the recommendations of the Croatian Institute for Public Health (distance measures, masks, disinfection regulations, maximum number of people, the period for ventilating the room etc.). These recommendations/restrictions, of course, varied over time depending on the COVID-19 infection values.
<b>Power</b>	<b>Availability</b>	There were no problems with the power supply.
<b>Connectivity</b>	<b>Telephone connection</b>	There were no problems with the telephone or mobile phone connection.
	<b>Internet connection</b>	Overall, there were no problems with the internet connection. However, in some parts of our institution, lecturers and teaching assistants had issues with WiFi connection (they were forced to use Ethernet connection)



<b>Institution</b>	<b>Physical access</b>	Initially, access was allowed only to university employees. Therefore, educators need to substitute learning resources from the physical environment with online resources.  After a certain period, students were allowed to enter the building and participate in the lectures (with distance restrictions and a limited number of participants). In addition, the major exams (I. and II. year) were organised in a physical environment considering the above-mentioned restrictions.
	<b>Online access</b>	There were no limitations regarding the online access to the online services or resources provided by the institution. However, the major issue is the limited number of these services and resources.
<b>Learning resources</b>	<b>Physical availability</b>	All physical learning resources were substituted with online resources (if possible).
	<b>Online availability</b>	Although many educators previously produced a lot of e-learning materials for their courses, they mostly perceived these materials as an add-on (in the pre-COVID era). Therefore, educators provided materials such as presentation slides, reading materials or useful links. However, lectures, tutorials and exercises had to be adapted and recorded for the purpose of virtual education. For certain courses, this included a major reconceptualisation of the way course content needs to be taught and delivered. Therefore, new materials were developed throughout the whole educational period.
	<b>Physical access</b>	All physical learning resources were substituted with online resources (if possible). Therefore, physical access was not allowed.
	<b>Online access</b>	The majority of online (learning) resources were available when they had to be delivered to students. Some educators provided their materials in advance. Please check <i>Online availability</i> .
<b>Personnel</b>	<b>Availability</b>	There were no limitations regarding the availability of educators. Many of them even provided students with e.g. their private mobile phone numbers to make this transition



		to COVID restrictions easier.
<b>Equipment</b>	<b>Availability</b>	<p>Initially, the equipment required for educational activities was partly available. The new servers had to be acquired by the institution for the purpose of e.g. conducting several exams for a large number of students in parallel.</p> <p>Students were required to use a computer with an Internet connection. However, for some courses, they were required to use advanced engineering software tools, which are very demanding in terms of computer power (this caused some issues and educators had to find an appropriate replacement). Unfortunately, replacement devices were not available for students.</p> <p>Some educators postponed certain course tutorials for later (for students that had equipment issues). These courses were conducted very near the course end in smaller groups and considering all restrictions.</p> <p>In general, research equipment was available only to staff. However, if required for Bachelor and Master thesis, students should ask for official permission from the Faculty Administration. Still, all restrictions and recommendations had to be followed.</p>
	<b>Suitability</b>	<p>For the most part, the available equipment was suited for the intended educational activities.</p> <p>As stated above, students were required to use advanced engineering software tools, which are very demanding in terms of computer power (this caused some issues and educators had to find an appropriate replacement).</p>

#### 2.1.4. POLITECNICO DI MILANO

<b>Movement</b>	<b>Geographic limitations</b>	<p>Restrictions of movement for everybody. Some workers have the possibility to reach their workplace with appropriate documents that declare their need (self-certification, to be verified by the authority upon checks in the street). Movement allowed just between home and the workplace.</p>
-----------------	-------------------------------	---



	<b>Requirement-based limitations</b>	Social distancing and the need of wearing at least surgical masks when moving/commuting. Cars should have not more than one person per row and people should sit to maximize the distance among the seats.
<b>Power</b>	<b>Availability</b>	There was no shortage of electricity and everybody could access the power supply from their home.
<b>Connectivity</b>	<b>Telephone connection</b>	Available for everybody without particular limitations
	<b>Internet connection</b>	On the side of educators, the university enabled access for those experiencing troubles with internet connection at home or in other places. Students might experience connection problems depending on the place where they live. Typically, the ones that live in big cities or close to them had no problems. On the contrary, the ones that live in the countryside and, especially, in villages on the mountains might have more severe problems that they can try to address with the connection of their mobile, which is in any case potentially unstable. Temporary breakdowns could be expected. Some problems might be related to the excessive consumption of the bandwidth for those families where more than one member needs to be connected at the same time.
<b>Institution</b>	<b>Physical access</b>	No students allowed to access the room for the lectures, professors can make their lecture from the room with personal devices in order to limit the interaction with shared devices
	<b>Online access</b>	All the services of the universities were available as online services.
<b>Learning resources</b>	<b>Physical availability</b>	They were not available to students, they could be accessed just for educators
	<b>Online availability</b>	Lectures carried out fully online. Two platforms allowed for carrying out lectures: MS Teams and Webex Meetings. Lessons to be recorded and then shared with an accessible link to students for rewatching (optionally, depending on prof's decision).



	<b>Physical access</b>	Students cannot access the facilities at all, except for the ones that need to conclude their thesis work within laboratories (labs were accessible by one person at a time).
	<b>Online access</b>	Fully accessible through the online platform for learning (learning management system). Lectures recorded live could be rewatched through an online service.
<b>Personnel</b>	<b>Availability</b>	People cannot access the facilities unless they receive an explicit authorization by the head of the department
<b>Equipment</b>	<b>Availability</b>	MS Teams for everybody, to run lectures with students and meetings with colleagues.
	<b>Suitability</b>	Sufficient. Some meetings with colleagues required additional tools to be used with screen sharing option on.

Lokanath Mishra, Tushar Gupta, Abha Shree, “*Online teaching-learning in higher education during lockdown period of COVID-19 pandemic*”, International Journal of Educational Research Open Volume 1, (2020)

## 2.2. CYBER ATTACKS - WANNACRY

In 2017 the ransomware WannaCry encrypted 230.000 computers in 150 countries. Cyber-attackers demanded money to lift the encryption on the data concerned. Europol describes the event as unprecedented in regard to the extent of the spread and economic damage. Since then, the event inspired other ransomware attacks such as Petya and NotPetya. Higher education institutions are especially at risk of being targeted by cybercrime as they heavily rely on a functioning IT system to deliver education and often only have little resources to provide proper protection against cyberattacks.

The following descriptions outline the general conditions of an institution in higher education that is affected by a cyber attack. As can be seen, the effects are focused on the online access to the institution and its learning resources.

<b>Movement</b>	<b>Geographic limitations</b>	The institution-specific attacks did not affect movement.
-----------------	-------------------------------	---



	<b>Requirement-based limitations</b>	The institution-specific attacks did not affect movement.
<b>Power</b>	<b>Availability</b>	The institution-specific attacks did not affect the availability of power.
<b>Connectivity</b>	<b>Telephone connection</b>	The institution-specific attacks did not affect the telephone connection.
	<b>Internet connection</b>	The institution-specific attacks did not affect the internet connection.
<b>Institution</b>	<b>Physical access</b>	Unrestricted access is possible as long as the electronic locking system is not affected. If this is affected, access must be enabled manually.
	<b>Online access</b>	The online access depends on the extent of the attack's success. In the worst case, access is blocked until the systems have been set up again.
<b>Learning resources</b>	<b>Physical availability</b>	The physical availability of learning resources is not affected by the attack.
	<b>Online availability</b>	The online availability depends on the success of the attack. In the worst case, all content has been encrypted and can no longer be produced. In this case, the learning content must be recreated as soon as the attack is averted and the systems are working normally again.
	<b>Physical access</b>	The physical access to learning resources is not affected by the attack.
	<b>Online access</b>	The online access depends on the extent of the attack's success. In the worst case, access is blocked until the systems have been set up again.
<b>Personnel</b>	<b>Availability</b>	The personnel are not affected by the attack.
<b>Equipment</b>	<b>Availability</b>	The personal equipment can be affected by the attack. In the worst case, it is not available until the system has been set



		up again.
	<b>Suitability</b>	The suitability is not affected by the attack.

Sources:

Europol, (2017, November 6), *Wannacry Ransomware*, Retrieved June 2, 2021, from <https://www.europol.europa.eu/wannacry-ransomware>

C. R. Harrell, M. Patton, H. Chen and S. Samtani, *Vulnerability Assessment, Remediation, and Automated Reporting: Case Studies of Higher Education Institutions*, 2018 IEEE International Conference on Intelligence and Security Informatics (ISI), 2018, pp. 148-153, doi: 10.1109/ISI.2018.8587380.

## 2.3. NATURAL DISASTER - AVALANCHE

Storms, earthquakes, floods, avalanches and extreme temperatures are the top sources of natural disasters in Europe. Extreme weather phenomena are increasing in the future due to climate change.

The following descriptions outline the general conditions of an area that is cut off from the outside world by an avalanche. As can be seen, all areas are affected by the crisis. Avalanches often only represent a short-term event lasting several days. If the institution is not directly affected, the end of the event can be waited for and lessons can then be continued. If the institution is directly affected (damaged or destroyed), long-time repairs are likely. In these cases it might be necessary to switch education to an online format or even another institution.

<b>Movement</b>	<b>Geographic limitations</b>	In the beginning it is often not possible to leave the affected regions. After the rescue teams arrive, an evacuation may take place. Free movement is only possible again after securing the slopes and clearing away the snow masses.
	<b>Requirement-based limitations</b>	Free movement is only possible with special equipment, which is usually only available to rescue teams.
<b>Power</b>	<b>Availability</b>	Depending on the disaster's severity, temporary to total blackouts are possible.





<b>Connectivity</b>	<b>Telephone connection</b>	Depending on the disaster's severity, temporary to total failures are possible.
	<b>Internet connection</b>	Depending on the disaster's severity, temporary to total failures are possible.
<b>Institution</b>	<b>Physical access</b>	Physical access depends on the possibility of movement and if the institution has been affected directly. In the worst case (destruction of the institution), access is not possible for a longer period of time.
	<b>Online access</b>	Online access depends mostly on the internet connection ( <i>see internet connection</i> ). If the institution has been damaged or destroyed, long-term restrictions are likely.
<b>Learning resources</b>	<b>Physical availability</b>	Physical availability depends on the possibility of movement and if the institution has been affected directly. In the worst case (destruction of the institution), access is not possible for a longer period of time.
	<b>Online availability</b>	Online availability depends mostly on the internet connection ( <i>see internet connection</i> ). If the institution has been damaged or destroyed, long-term restrictions are likely.
	<b>Physical access</b>	Physical access depends on the possibility of movement and if the institution has been affected directly. In the worst case (destruction of the institution), access is not possible for a longer period of time.
	<b>Online access</b>	Online access depends mostly on the internet connection ( <i>see internet connection</i> ). If the institution has been damaged or destroyed, long-term restrictions are likely.
<b>Personnel</b>	<b>Availability</b>	The availability of personnel depends on the individual circumstances. In the worst case, personnel are not available for a prolonged period.
<b>Equipment</b>	<b>Availability</b>	The availability of equipment depends on the individual circumstances. In the worst case, equipment might not be available for a prolonged period.



	<b>Suitability</b>	The suitability is not affected by the event.
--	--------------------	---

## 2.4. NATURAL DISASTER - FLOODING

Severe flooding occurred in several European countries in July 2021. Entire villages were destroyed in the process.

The following descriptions outline the general conditions of an area that is heavily affected by the flooding with all its infrastructure destroyed. In such severe cases, all areas are affected by the crisis. If the institution is not directly affected, the end of the event can be waited for and lessons can then be continued. If the institution is directly affected (damaged or destroyed), long-time repairs are likely. In these cases it might be necessary to switch education to an online format or even to another institution.

<b>Movement</b>	<b>Geographic limitations</b>	The flood event led to a short-term total restriction of freedom of movement. Due to the speed of the rise in water, leaving the affected regions without help was mostly impossible or difficult. As a result, it was not possible to move freely without danger. It was only possible to leave the region after the rain had subsided.
	<b>Requirement-based limitations</b>	During the first time, free movement was only possible with special equipment, not possessed by regular students.
<b>Power</b>	<b>Availability</b>	In the hardest hit regions, the floods resulted in a total failure.
<b>Connectivity</b>	<b>Telephone connection</b>	In the hardest hit regions, the floods resulted in a total failure.
	<b>Internet connection</b>	In the hardest hit regions, the floods resulted in a total failure.
<b>Institution</b>	<b>Physical access</b>	If the institution has been affected directly, access is not possible for a longer period of time.
	<b>Online access</b>	Short-time restrictions are imposed by the failure of internet access. If the institution itself has been damaged or



		destroyed, long-term restrictions are likely.
<b>Learning resources</b>	<b>Physical availability</b>	If the institution has been affected directly, access is not possible for a longer period of time.
	<b>Online availability</b>	Short-time restrictions are imposed by the failure of internet access. If the institution itself has been damaged or destroyed, long-term restrictions are likely.
	<b>Physical access</b>	If the institution has been affected directly, access is not possible for a longer period of time.
	<b>Online access</b>	Short-time restrictions are imposed by the failure of internet access. If the institution itself has been damaged or destroyed, long-term restrictions are likely.
<b>Personnel</b>	<b>Availability</b>	The availability of personnel depends on the individual circumstances. In the worst case, personnel are not available for a prolonged period.
<b>Equipment</b>	<b>Availability</b>	The availability of equipment depends on the individual circumstances. In the worst case, equipment might not be available for a prolonged period.
	<b>Suitability</b>	The suitability is not affected by the event.

Sources:

Bisaro, Alexander; Rokitzki, Martin; Hofemeier, Alannah (2020), *Climate impact induced crisis in Europe: An exploration of scenarios*, Berlin: Heinrich Böll Foundation

/ Finanzwende

Jongman, B. (2018), *Effective adaptation to rising flood risk*, Nature Communications 9, 1986. <https://doi.org/10.1038/s41467-018-04396-1>

Paprotny, D., Sebastian, A., Morales-Napoles, O. & Jonkman, S.(2018), *Trends in flood losses in Europe over the past 150 years*, Nat. Commun



*CResDET*



Co-funded by the  
Erasmus+ Programme  
of the European Union

**Erasmus+ Project Crisis-Resistant Digital Education and Training**

---



### 3. OUTLOOK ON FUTURE CRISIS SCENARIOS

**Objective:** Classification of possible future Covid-19-related scenarios and their effects on design education.

**Disclaimer:** It is almost impossible to predict the further course of the Covid-19 crisis. The following statements outline three possible scenarios and are only intended to give an outlook on possible events. It cannot be predicted whether one of these scenarios will occur in the same or a similar way.

#### 3.1. OUTLOOK 1: COVID-19 CRISIS ENDS

If the population develops sufficient immunity through the vaccinations, the crisis will end as soon as the vaccination rate is high enough. In this case, restrictions are likely to be slowly removed before they end completely.

It is expected that the crisis will lead to an increasing digitization of education even after its end. As a result, the experience gained and the concepts developed do not lose their viability, but can also be used in the future to a certain extent.

#### 3.2. OUTLOOK 2: NEW VARIANTS WITH SEASONAL EFFECTS

If it is not possible to completely eradicate the virus because the mutation rate is too high, a persistent crisis can be assumed. The severity of the crisis and its conditions are mainly determined by the properties of the mutants, the effectiveness of the vaccinations, the vaccination rates and seasonal effects. In the best case, the scenario is comparable to the descriptions in (F-1). In regular cases, the scenario is comparable to the descriptions in (E-1). Most of the time, the current state will vary between these two states. In the worst case, the scenario is comparable to the descriptions in (F-3).

#### 3.3. OUTLOOK 3: WORSENING COVID-19 CRISIS

In case of a worsening Covid-19 crisis, conditions similar to the conditions at the beginning of the crisis are likely.

<b>Movement</b>	<b>Geographic limitations</b>	In case of a worsening crisis, the movement of educators and students will likely be severely restricted or completely prohibited. To ensure continued education, all design education-related activities should be substituted with online activities.
	<b>Requirement-based limitations</b>	In case of a worsening crisis, the movement of educators and students will likely be severely restricted or completely prohibited. Major restrictions like the requirement of vaccinations are possible. To ensure continued education,



		all design education-related activities should be substituted with online activities.
<b>Power</b>	<b>Availability</b>	Problems with the power supply are not likely.
<b>Connectivity</b>	<b>Telephone connection</b>	Problems with the telephone connection are not likely.
	<b>Internet connection</b>	Problems with the internet connection are not likely.
<b>Institution</b>	<b>Physical access</b>	In case of a worsening crisis, physical access will likely be restricted to key personnel. To ensure a continued education, all design education-related activities should be substituted with online activities and the learning resources made available online.
	<b>Online access</b>	There are likely no limitations regarding the online access to the institution or its resources.
<b>Learning resources</b>	<b>Physical availability</b>	In case of a worsening crisis, physical learning resources should be replaced with online learning resources.
	<b>Online availability</b>	There are likely no limitations regarding the online availability of learning resources.
	<b>Physical access</b>	In case of a worsening crisis, access to physical learning resources is likely restricted. Therefore, all learning resources should be replaced with online learning resources.
	<b>Online access</b>	There are likely no limitations regarding the online access of the learning resources.
<b>Personnel</b>	<b>Availability</b>	In case of a worsening crisis, limitations regarding the educators' availability are possible. Missing educators have to be replaced or the course content has to be adapted to their availability. If this is not possible, the course content must be changed to free learning.



<b>Equipment</b>	<b>Availability</b>	The availability of equipment is not affected by a worsening Covid-19 crisis.
	<b>Suitability</b>	The suitability of equipment is not affected by a worsening Covid-19 crisis.