Cris

Combating crisis situations by innovative STEM tools and entrepreneurship skills

HANDBOOK FOR TEACHERS

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What is the CRIS project all about?

Through history and during the COVID-19 pandemic that severely affected the EU, as well as the entire world, it became evident that we are not prepared well enough to successfully manage such situations. However, tens of thousands of individuals from around the world were extremely fast to respond to the life-dependent situation of lack of medical and personal protection equipment (PPE). The observation, that triggered the need for this project, was that majority of these individuals shared the same 3 key characteristics:

1. Prosocial behaviour and genuine concern and care for people
2. The “can do” attitude where and when presented with a challenge
3. Awareness of key enabling STEM and digital technologies

The right combination of behavioural characteristics, entrepreneurial mindset, and awareness of STEM technologies enabled around 100,000 people to produce alternative solutions for the protection of people and frontline professionals when there was no other way to protect them due to the extreme shortages of the PPE.

While the project was triggered out of the observations during the COVID-19 pandemic, such behaviour can be observed daily, where individuals and communities across the globe engage in solving major local, regional, national as well as international challenges for the good of everyone affected. These people too, share the above-mentioned characteristics.

The raised awareness of teachers and pupils that changing our approaches can have a great impact on our reactions to future actions can present us with the possibility to know how to think and act when again faced with struggles, being on a personal or general level as a nation or worldwide.

Having everything above mentioned in mind, this handbook will prepare, equip and guide teachers on the use of entrepreneurial and growth mindset, novel technologies such as 3D printing, Virtual and Augmented Reality, as well as fundamental ideas behind crisis management to help develop prosocial and proactive behaviour in pupils when presented with a challenge or a threat. With proper guidance and an entrepreneurship mindset, coupled with the crisis management and use of innovative STEM technologies, new abilities are easy to teach and learn.

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1. Crisis management in modern world

1.1. CRISIS

There are many types of crises in the world, such as natural, technological, economic, confrontation crises, a crisis of malevolence, a crisis of organisational misdeeds, and many more. A crisis often occurs after some unpredictable events or because of the unforeseeable consequence of some event that had been considered a potential risk. It can affect individuals, groups, organizations, or even society.



Image 1, 2 and 3: Different situations of crisis. [Photograph]. Canva Stock.

3 characteristics of crisis:

- It is a sequence of sudden disturbing events which produce physical, mental, social, and/or economic damage.
- It generally arises on short notice, even though some of them could be predicted.
- It triggers a feeling of fear and threat amongst the individuals

Students can be exposed to unexpected situations, that don't need to be on such a large scale as a pandemic, but are still on one hand stressful and on the other offer an opportunity for proactive thinking, for example:

- FIRE IN SCHOOL: a fire damaged the school building and the pupils need to cope with a new situation all of a sudden (new location of the lessons, possible difficulties how to get there, adjusting to new spaces, etc).
- REFUGEES: students need to adapt to sharing their town and school with a larger group of refugees that don't speak the local language and might have changed the dynamic of their community with their presence (an example of when kids could come up with ways to overcome the language barriers in communication and think of how to make their foreign fellows welcome).
- LACK OF SPORTS ACTIVITIES: a side effect of the pandemic was also a long-term suspension of all extracurricular activities, especially those that involved gathering, such as sports

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activities. Students are presented with the challenge of how to keep their hobbies, stay active and healthy while respecting the restrictions, etc.

These and many other stressful situations such as bullying, financial crisis, parents divorcing, severe health problems in the family etc. can occur and affect a person's life and psychological well-being to a great extent.

However, it is important to know, that crisis is not the end of the world. Negative consequences of every crisis can be managed, prevented, turned into a positive outcome, or at least mitigated with a proper approach. Considering there are many types of crisis, also the problem-solving technique differs. However, all of them have some basic principles in common, including crisis management.

1.2. WHAT IS CRISIS MANAGEMENT?

Crisis management is the application of strategies designed to minimize the damage caused by the crisis. Making correct quick decisions and valid communication is a key action capability in any crisis. It is important not to panic and to have a well-prepared team searching for solutions.

Stages of the crisis management model consist of:

1. Assessing the situation
2. Planning
3. Implementing the plan
4. Helping others with your solution

Image 4: Stages of the crisis management. [Photograph]. Canva Stock.

1.2.1. Assessing the situation (diagnosis)

First, find out where the problem originated and then start working on strategies to solve the crisis. The investigation, what things or decisions led to the crisis, is important to avoid repeating the same mistakes.

Gather correct and relevant information: it is important to avoid depending on guesses, rumours, and assumptions but to depend on checked facts before making any quick decisions. Discussions are important: brainstorming for potential solutions is encouraged.

1.2.2. Crisis management plan

It is a detailed plan that describes the various actions, which need to be taken during critical situations or crises. The plan should be done before the crisis happens. Having such a plan enables

individuals to stay focused during emergencies, reduce the after-effects of crisis and take quicker and more relevant actions to help the situation.

Characteristics of a crisis management plan:

- It must be an open discussion where everyone involved can share their ideas, and give valuable inputs and suggestions.
- It is important that the plan is realistic and solves the purpose of arising problems.
- It is not created to solve just the current crisis but also to prevent any similar crisis in the future.

Image 5: Open discussion. [Photograph]. Canva Stock.

- It should contain response procedures in a step-by-step plan for specific potential situations that the organization or people have to be prepared for.
- It should include crisis management-related policies with assigned roles for people so that everybody knows what their job is.
- It should be reviewed and updated periodically or based on any new development that might emerge over time.

1.2.3. Implementing the plan

Do your best to carry out your plan but be open to adjustments and improvements if necessary. Effective communication is essential to overcome a crisis: everybody should be aware of the situation and everybody should have a right to suggest their ideas and opinions. Changes are inevitable, accept them and work for the best possible outcome.

1.2.4. Help others with your solution

Take a look at what you have learned, improve your solution, if necessary, and share your ideas so you can help others in similar situations.

1.3. STEPS FOR SUCCESSFUL OVERCOMING CRISIS – HOW YOU CAN HELP?

1. Everyone involved should be transparent and should be provided with all the information they need during a crisis.
2. It is advisable that everybody help in their way. If someone comes up with a possible solution or just an idea on how to minimize the damage, they should not keep it to themselves but spread their suggestion amongst everyone involved.
3. What are the needs in the crisis? Think, if you can help with supplies, for instance with food, water, cleaning supplies, equipment or just with company…
4. Talk with bigger organizations, who are in the field, to find out what is needed. Money is a better option than big supplies, which are hard to send. Also, filters for drinking water cost less than big amounts of bottled water, which are also harder to store. Each case is unique, don't be afraid to ask.
5. You can find the solution, for example: If you do not have money, you can sell things to get some and then donate. Be creative!
6. Organizational activity is needed when working under time pressure. Don't be afraid to take an initiative to help overcome the situation.
7. Roles must be appointed: make sure the right person is doing the right job and that everyone is motivated for a positive outcome.
8. It is important to remain calm. Unnecessary stress makes situations worse.

Since the aim of the CRIS project is the crisis recognition and awareness of pupils' capability to create plans and play an important role in the crises solutions, the next chapter presents the topic of entrepreneurial mindset and how to act on the challenge. Since we are not talking about the entrepreneurial thinking in a business sense but in a sense of nurturing a pro-active attitude and learning how to turn crises into an opportunity we will be referring to it **Doers' mindset** instead.

2. Doers' mindset

Doers' mindset is one of the key skills that help an individual think and act toward developing a crisis solution. It is the combination of growth mindset and behavioural characteristics that make us proactive instead of only complaining and waiting for the problem to resolve it self. Therefore teaching pupils how to develop their own doers' mindset is one of the main focuses of the CRIS project.

2.1. WHAT IS ENTREPRENEURSHIP AND HOW IS IT CONNECTED WITH DOERS' MINDSET?

Entrepreneurship is the activity of setting up something new in the process of taking on risks in an attempt to increase or create value. It can be viewed as the pursuit of opportunities irrespective of the context: start-up or corporate, for-profit or not-for-profit, public or private, discovery or creation. Crisis and opportunities, from an entrepreneur's point of view, are two sides of the same coin.

Image 6: Entrepreneurs. [Photograph]. Canva Stock.

Although the crisis is never good in its own right, something useful and new can be found in every such event - innovative goods and services, novel markets, transformed methods of production, new sources of supply, and "new organization of any industry".

Entrepreneurs are usually most effective under conditions of high uncertainty or when they are dealing with a serious deficiency of resources and the probability of failure is high. We can observe that these characteristics are very similar to those of crisis. Doers' mindset is key to successful crisis survival.

The outputs of the CRIS project will focus on providing entrepreneurial tools and mental patterns that will help children battle, address and prevent crises, rather than specifically focusing on the business/money aspect of the entrepreneurship. The aim is to raise responsible young people who can add value to their community and environment.

2.2. TYPES OF MINDSETS

Pupils' success should not be assessed only in cognitive abilities and knowledge but also in non-cognitive factors, such as their beliefs, attitude, and values. One of the most influential non-cognitive skills is their view to which extent the intelligence is considered a stable trait, also known as mindset.

There are two types of mindsets in regard to intelligence. The first one, called fixed mindset is a mindset where an individual considers intelligence as a stable trait that you are born with and cannot be changed without significant effort and support. The second one is called the growth mindset and it describes someone's awareness that intelligence is a fluid thing that can be improved and expanded.

What we refer to as the doers' mindset is fundamentally rooted in the growth mindset but transitioned into "doing" setup. It is a set of skills that enable people to identify and make the most of opportunities, overcome and learn from setbacks, and succeed in a variety of settings. It is a way of thinking that enables you to overcome challenges, be decisive, and accept responsibility for your outcomes. It is a constant need to improve your skills, learn from your mistakes, and take continuous action on your ideas. These are also characteristics of a doers' mindset. Having such a mindset is highly valued by employers, it boosts educational attainment and performance, and is crucial for creating successful new businesses.

2.3. CHANGE IN MINDSET OVER TIME - IS IT POSSIBLE TO CHANGE A FIXED MINDSET INTO A GROWTH ONE?

It is important to notice that pupils' mindset is mouldable and change through their education and their life. If the impact of a pupil's mindset is known to educators and parents, the pupils are more likely to adopt a growth mindset for life. Fortunately, studies show that pupils can change their mindset through one year, some even quicker.

2.4. FACTORS INFLUENCING PUPILS MINDSET

Different non-cognitive factors influence pupils' mindsets, such as types of goals pupils set, how they attribute their success and struggle, and how they cope with challenges. Pupils need wide support, from home to school environment, to change their mindset into a growth and a doers' one, which could improve their ability to cope with crisis anywhere: in school, in future in work, business, at home, and in society.

1. **Special training activities:**
   Schools can work with online programs, specialized in mindset training. Those kinds of programs are easy to implement, are standardized and scalable, but they cannot guarantee their success with application in practice. Better results are shown by intervention embedded into the school context with a real teacher.

1. **Educator with the growth mindset characteristics:**
   In daily interaction implement mindset training in your lessons – use mindset interventions. Adapt your teaching style to be in line with growth mindset norms by playing mindset games, and giving mindset feedback. Teachers' instruction help to shape the pupil's mindset and can consequently influence their overall success.

Some practical advice the teacher can use to support the growth mindset in the classroom:

- Support the individual learning process
- Promote mastery goals
- Be persistent with high expectations and accept no helpless behaviour
- Foster process orientation

You can find more information in the supplementing Guides and Curricula of the CRIS project.

3. Digital technologies

Digital technologies offer handy solutions to our everyday problems and tasks so most of people are familiar with using these tools on a daily basis. The CRIS project aims to take the use of digital technologies among students one step further and will present some ideas and examples on how to use them for learning, familiarizing students with hypothetical crisis situations and teaching them how to use digital technology when tackling a crisis.

CRIS explores the use of Virtual and Augmented reality and 3D printing. With the help of Virtual and Augmented reality students can explore hypothetical crises situations without having to be exposed to them in real life, while 3D printing could be used for creating materials that might be in high demand but scarce during a crisis.

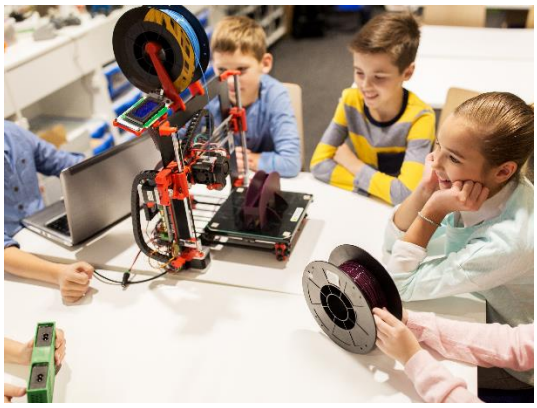

Image 7 and 8: Pupils using 3D printer and VR glasses. [Photograph]. Canva Stock.

Even if the CRIS project describes these two digital technologies, students should be encouraged to use any technology that suits their case.

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3.1. VIRTUAL AND AUGMENTED REALITY

3.1.1. What is virtual reality (VR) and augmented reality (AR)

VR uses advanced computer technology to create a simulated environment. Instead of just watching the screen and observing the situation you can immerse into the 3D world where your senses such as vision, hearing, touch, and even smell are stimulated.

VR enables you to experience a completely new world without any traces of the real one. On the other side, augmented reality (AR) builds on the existing real world and makes (digital) adjustments to it. We do not experience a new world with it but it simply augments the current state of presence. For example, VR enables you to swim with sharks and AR enables you to watch the shark pop out of your business card. One of the biggest differences between the two is that VR is more immersive while AR allows more freedom and possibilities when it comes to the users since it does not need special equipment – a smartphone or tablet will suffice.

Image 9: Girl using VR glasses. [Photograph]. Canva Stock.

Image 10: Girl using AR app. [Photograph]. Program ace.

3.1.2. Use of VR and AR

The use of VR and AR is widely spread in the nowadays world. New products are entering the market and creating many opportunities in business, such as gaming, media & entertainment, training and simulation in education, health, etc. Furthermore, AR and VR can enhance the experience of watching a film, playing games, or any other activity and are quickly gaining on their popularity.

3.1.3. VR and AR in the education

The way we learn today has some key challenges. Teaching methods are still about fact retention and concentrate on presenting students with facts about a subject. Students have easier access to information but receiving a lot of information dominantly in an oral way over a short period of time can be overwhelming for them and difficult to comprehend. The majority of current teaching styles, tools and methods are inferior to some of the more modern ones, which provide more interaction,

and engagement and they help to motivate students to continue learning even after the active teaching period is over.

All this leads to disengagement, even boredom of students, where, for example, VR and AR technologies have so much to offer to get students interested and invested in the learning material.

Extended reality technologies have the potential to make learning more effective, more engaging, and more relevant for today's tech-driven world. That leads to a greater understanding of advanced concepts.

Novel education tools and methods leverage VR/AR technologies to create immersive and blended environments in which users can engage and interact with objects and systems, including those that are too small, too large, too dangerous to experience in real life, or they simply exist in the history or over prolonged timescales, or they are in the lands far away. With virtual reality, users can assemble, disassemble, manipulate, and modify objects and environments in ways that have never previously been possible.

Image 11: Using AR. [Photograph]. Canva Stock.

In general, learners remember far more about something through simulation and direct experience as opposed to just reading, seeing, or hearing about it. VR is applicable at all levels of education – from primary schools to universities. The key is setting up the virtual reality content so that it is appealing to the target audience.

3.1.4. Best practices of using AR and VR in education and learning

- **Incorporation of AR/VR into educators teaching routines**

Image 12: AR textbook experience. [Photograph]. Timbuk Toys.

In the classroom, teachers use AR apps to animate science textbooks and study flashcards to make the experience more enjoyable for the student. Some teachers also use AR to enhance homework by incorporating interactive puzzles and quizzes for their students.

- **Creating an immersive experience for schoolchildren**
  Thanks to its highly immersive nature, VR can transport students to different places, and even different times. In history class children could be taken to a virtual recreation of historical sites and events, and in technology, they can check a virtual tour of machines and engineering projects. In science class, they can virtually travel into space or explore the human body, animals, and plants

- **Enabling exciting new field trips**
  With VR and AR, students can visit places they have never seen before and in which school expedition organizers could never arrange in the real, physical world, due to the cost. Teachers are no longer limited by the classroom walls. VR lets students explore the world virtually, while AR brings abstract concepts to life, allowing teachers to guide students through collections of scenes and objects, and to point out interesting sites and artefacts along the way.

  During geography class students can virtually visit geographic locations and habitats anytime they are learning lessons about them. In art and culture classes students can attend cultural events in virtual reality and learn to paint, sculpt, or do pottery in VR. Also in classes of architecture and design, they can watch the creation of architecture projects in virtual reality, and visit celebrated buildings.

Image 13: "VR for Impact" - Tree. [Photograph]. HTC VIVE's blog.

- **Transforming hands-on learning**
  Dissection of the frog is not a very pleasant thing to do, but it is still very educational. Now, this gruesome experience can be replaced by AR. In science class, virtual labs can be used for a hands-on time in a lab to master the different skills and techniques they are taught in class. VR technology offers a realistic lab experience that lets users perform experiments and practice skills in a fun and risk-free learning environment with the ability to view life science at the molecular level, to examine scenarios that highlight the connection between the lab experience and the real world, and to speed up experiments so results can be seen faster.

- **Game-based learning**
  Game-based learning is outstanding because it increases engagement and motivation by placing learners in a simulated environment where they can experience important lessons with minimised risks. A lot of impossible things in real life can be done virtually. The visual and kinaesthetic experiences in virtual worlds contribute to the learning ability of users.

- **Training**

VR is a practical solution for technical training fields like the military, engineering, or medical sectors. Virtual reality simulations help students learn practical skills, they can learn from realistic scenarios without the risk of practicing an unfamiliar skill in an uncontrolled real-life situation.

Image 14: VR training. [Photograph]. Canva stock.

- **Online classroom**

Online courses and online classrooms have proven to be ineffective means of learning because of the lack of student engagement. VR education makes learning experiences social by allowing students to communicate and discuss with each other and feel more involved.

- **Special education**

Image 15: VR in class. [Photograph]. Charlton Park Academy.

For people with physical disabilities studying and exploring the world through a VR headset is a great option. Both AR and VR increase motivation, facilitate interaction, develop cognitive skills, and improve short-term memory. Lessons become more enjoyable. The most profound effect lies in the improvement of communication skills, especially in students with hearing problems. For autistic students, VR seems to encourage social interaction.

For learning-disabled individuals, AR can improve vocabulary through gamification. Interactive textbooks use 3D images, audio clips, and videos to explain the text. VR has also been effectively used to tackle social anxiety, language deficiencies, attention deficit hyperactivity disorder (ADHD), physical or motor disability, cognitive deficits, dyslexia, and Down's syndrome.

3.2. 3D PRINTING

3.2.1. What is 3D printing?

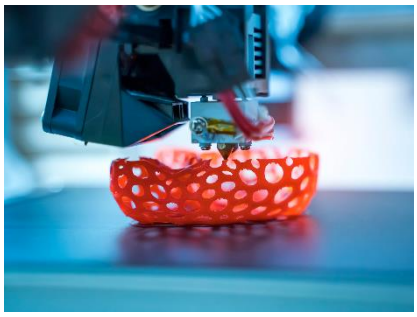

Image 16: 3D printing. [Photograph]. Canva stock.

3D printing or additive manufacturing is the process of making three-dimensional solid objects from a digital file. We can create a 3D object by laying down successive layers of material until the final object is formed. It is also a way to produce complex objects by using less material than traditional manufacturing methods.

3.2.2. How does it work?

It starts with a 3D model which you can create on your own or you can download it. Many tools can be found on the internet that is free and beginner-friendly. Once we have a 3D model we have to prepare it for our 3D printer with a step called slicing. The 3D model is sliced into thousand layers that form the object when put together. When a 3d model is sliced, it is ready to be printed in a 3d printer. Send the file to a 3D printer and layer by layer the model will be printed.

3.2.3. 3D printing in education

Applying 3D printing in education has a wide variety of important uses in primary and secondary schools, universities, libraries, technical colleges, and other educational settings. It is important to be aware that 3D printing cannot be successfully used in education without educators who understand the design principles of additive manufacturing and how to use 3D printers and filaments. Teacher training and 3D printing workshops can ensure students get the most from 3D printing being used in education.

3D printing enables students to materialize their ideas in a fast and affordable way. 3D printing technologies facilitate improved learning, skills development, and increased student and teacher engagement with the subject matter. Furthermore, it sparks greater creativity and collaboration in solving problems.

Image 17: Pupils 3D printing. [Photograph]. Ultimaker.

Researches highlight how 3D-printed artefacts provide learning benefits that are not achievable with screen- or paper-based learning. Improved understanding comes through touching and physically observing 3D-printed objects. 3D printing promotes learning through exploration

instead of outdated methods that only focus on learning from textbooks. It also provides many opportunities to aid visual and practical learning across the sciences. 3D-printed components are often used as test models for scientific experiments across different disciplines, including mechanical engineering, aerospace, and robotics.

To sum up in bullet points, the use of 3D printing in schools can be beneficial for the following reasons:

- Teaching students about 3D printing, how 3D printing technology works, and its applications in real-world scenarios (e.g. streamlining industrial processes)
- Informing educators about 3D printing so it can be incorporated appropriately into learning curriculums
- Improving student creativity and design skills
- Improving the education of spatial skills with the use of 3D-printed visualizations
- Providing students accurate physical prototypes which provides practical, hands-on knowledge useful for understanding scientific concepts with printed 3D artifacts
- Improving students' public-speaking abilities by using 3D-printed objects during oral presentations and demonstrations; Public speaking skills become crucial when students enter the workforce.

3D printers are more affordable than ever and easier to use. Schools need robust printers built for the demands of daily classroom use while also being affordable and user-friendly. If you have a 3D printer in school or your classroom, it provides the foundation for innovating and solving problems.

3.2.4. How is 3D printing connected to crisis management?

3D printing can have various uses also out of the educational system. The CRIS project was founded on the example of how a crisis situation during the COVID-19 pandemic and the lack of protective equipment was tackled by a group of volunteers who have had a brilliant yet simple idea – printing 3D protective masks adapted for medical staff and individuals.

Image 18: Gladius mask.
[Photograph]. David Kvaternik.

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Image 19: Alex's 3D printed bionic arm. [Photograph]. Limbitless Solutions.

Another example was when a mechanical special effects artist, who was driven by a wish to help a carpenter that had lost his fingers and later on a boy who was born without fingers, developed a mechanical arm with an open licence that could be 3D printed and used by everybody.

There are many ways moderns technology can be used for our benefit and for tackling crises – the aim of the CRIS project is to teach students not necessarily to know the digital technologies into detail but to be aware of it – that it is there and can be used for a good cause.

4. CRIS – an added value to the teaching and learning process

As a teacher/mentor/counsellor, you play an important role in shaping your students' personalities and knowledge and consequently you play a role in shaping their future. Encouraging students to develop a growth doers' mindset, equipping them with knowledge of entrepreneurial thinking in connection with crisis management and the use of digital technologies is a great added value to their education.

The CRIS project offers you a **set of tools** that you can take advantage of in preparing your lessons:

- **Crisis management guide**
- **Doers' mindset guide**
- **AR/VR & 3D printing guide**
- **Curricula supplementing the guides**
- **Booklet for redesigning existing lesson,**
- **Instructional videos**
- **Infographics**

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WHAT IS GREAT ABOUT THE CRIS PROJECT:

- It helps students develop a doers' mindset.
- It encourages entrepreneurial thinking together with prosocial behaviour.
- Promotes the "can do" attitude.
- Shows how to use innovative STEM technologies to make teaching and learning easy and fun.
- All the materials are at disposal and free to use.
- The content is organized modularly so teachers can use the full package or only select the topics most suitable for their teaching lessons.
- And the best part – it is all available online on CRIS project website.

FIND MORE AT:

www.crisproject.com

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