



MICROBE



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Minimizing the influence of coronavirus in a built environment

MICROBE

**IO1/A4. Development of a common framework for
MICROBE curricula (v1)**

Project No: 2020-1-LT01-KA203-078100

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Integrating education with human behavior relevant to influence of coronavirus and negative emotions in a built environment (MICROBE)

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1 INTRODUCTION TO THE DEVELOPMENT A COMMON FRAMEWORK FOR MICROBE CURRICULA REPORT

This report consists of the relevant findings and recommendations for the IO2/A4 Development of a common framework for MICROBE MOOC (Massive Open Online Course) curricula. Different methodological approaches were used to collect and analyze data for preparation this report.

The current report is based on the already applied stages of the Intellectual Output IO1 methodology:

1. Stakeholders' workshops to analyze needs, gaps and possibilities for common curricula development. The kick off meeting is foreseen as best opportunity to establish a common plan toward completing the work. The Project Kick-off Meeting, originally planned in Bulgaria, was held online on December 16th 2020, due to the COVID-19 restrictions, and was highly successful and fruitful.

2. Preparation of reports by each university. In order to pre-assess the current state of education on influence of coronavirus and negative emotions in a built environment (MICROBE) in the European universities, educational requirements and stakeholders' needs, capacities of the project partners to provide necessary infrastructure, context and resource base for education and research, workshop alongside with the kick-off meeting were organized.

- An extensive literature review was conducted to gather information on education system, education policies, educational gaps and needs, staff trainings, curriculum development which are the required/ identified information based on the Capacity Needs Assessment Methodology (CAPNAM) proposed by the United Nations (2013) in levels of country, organizational and individual.
- Based on the requirements for the report, many web sites were referred including websites which are belonged to government ministries, different universities, University grant commission, non-government organizations etc.
- Interviews and rounded table discussions were conducted in the institutional level according to requirements of information for the report and academic staff (including professors, senior lectures, lectures), non-academic staff (including deputy registers, senior assistant registers academics/examination, scientific assistants, industrial placement officers, directors of units), technical staff (including research assistants, demonstrators, technical staff) and students were intervened through the process.
- The collected information was used to develop the report by the reporting committee with the consultants who are engaged with the project.



3. Development of MICROBE cooperation for innovation and strategic partnerships for higher education framework. Partners collected gaps analyses at the European levels to classify together national, regional and international priorities. O1/A3 Framework for the partner country reports on current state of higher education and its relationship with humans' behavior on influence of coronavirus and negative emotions in a built environment was developed. This revealed MICROBE knowledge areas that can be improved. Gap analysis involved determining, documenting, and approving the difference between MICROBE requirements and available capabilities.

4. Development of guidelines and accreditation rules for the quality assurance of MOOCs. To ensure the quality of personalized, recognized and certificated MOOC modules special guidelines and accreditation rules were developed and will be adopted in each participating university. For this purpose Manual for Quality Assessment for E-learning (2012) by European Association of Distance Teaching Universities (EADTU) and OpenupEd quality benchmarks (<http://www.openuped.eu/>) will be used.

5. Preparation of the framework report for the common MICROBE curricula. The report will describe the common philosophical, pedagogical and practical understanding and capabilities of the partner institutions forming the basis for MICROBE personalized MOOCs development and delivery.

The next activities for the project implementation will be undertaken as planned:

6. The first intermediate meeting will be held on 6th October, 2021 on the Zoom platform. Intellectual Output IO1 and IO2 will be discussed in detail, a summary of key actions and priorities for the next 6 months, and planning towards next meeting will be covered.

7. Preparation of the report on common grounds for teaching and learning.

8. Training of teaching staff and public employees (experts, municipal employees, technicians, etc.). The framework report for the common curricular and the report on common grounds for teaching and learning will be presented and discussed during the short-term joint staff training event to be organized by Tallinn University of Technology. During the event teaching staff and public employees (the need to increase their specific skills on this topic) will gain competences necessary for development of the new MOOC modules and student-centered teaching approaches.

9. Development of the MICROBE personalized MOOCs content and teaching materials suitable for innovative delivery mechanisms as proposed in the intellectual output IO3. Since the MICROBE personalized MOOCs content will be influenced by the findings of the previous reports, the new knowledge creation and dissemination will be triangularised with education (input from existing MICROBE module base), innovation (new online delivery and dissemination strategies as described in the intellectual outputs IO3 and through institutional (built environment organizations) and research (through the shared research base across institutions).



The broader objective of the project – to upgrade the curricula with 3 new harmonized multidisciplinary, personalized MOOC modules on minimizing the influence of coronavirus and negative emotions in a built environment by applying behavior change (MICROBE) to increase cooperation for innovation and strategic partnerships for higher education, enhance the quality and relevance of knowledge of students to the global market needs and to ensure international cooperation.

This report shall be referred from all the PCHEI (Partner Country Higher Education Institutions) when developing the curricular for the proposed MICROBE MOOC courses. The recommendations and suggestions shall be accommodated to the maximum possible extent in the proposed curricular, hence all the MOOC courses will follow the same structure while maintaining the quality and consistency in the module outcomes.

2 IO1/A4 DEVELOPMENT OF A COMMON FRAMEWORK FOR MICROBE CURRICULA

The report will describe the common philosophical and pedagogical understanding and capabilities of the partner institutions forming the basis for MICROBE adaptive MOOCs development and delivery. The report will be based on findings of IO1/A3 (adopted Capacity Needs Assessment Methodology (CAPNAM) for Planning and Managing Education (United Nations 2013), cross-institutional consultations to discuss and identify in detail any outstanding incompatibility issues.

The proposed MOOC modules should always be adhered to the following objectives:

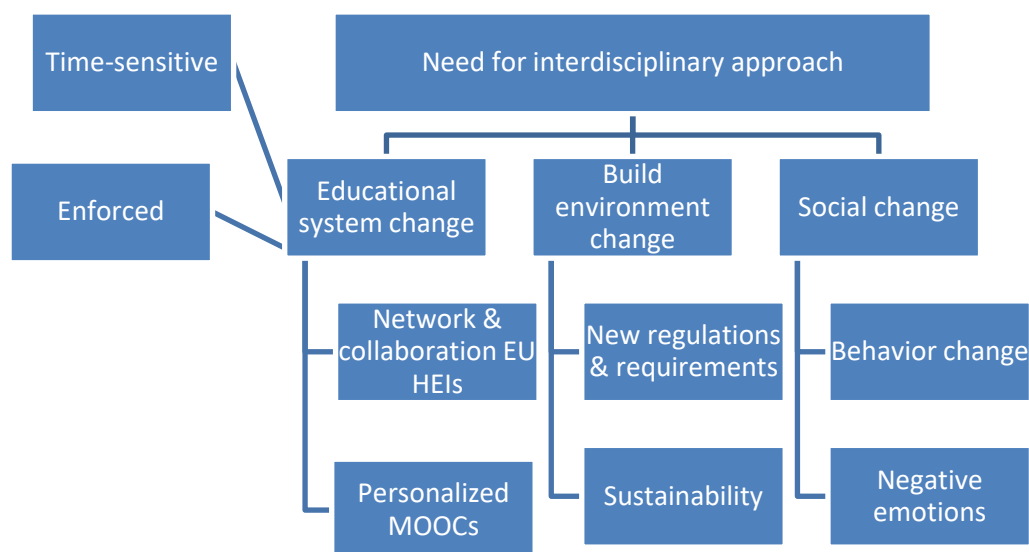
1. To upgrade curricula of MSc by adding 3 new multidisciplinary personalized, recognized and certificated MOOC modules on consumer behavior change related to MICROBE education, to enhance the quality and relevance of education in participating universities to global issues.
2. To develop world-wide innovative MICROBE System. It comprises the following components: Video Neuroanalytics, Web-based opinion analytics and Recommender System for the Protection against COVID-19 and Depression Reduction in Built Environment and 3 new harmonized multidisciplinary personalized MOOC modules.
3. To strengthen educational and scientific networking among EU universities in the MICROBE education.

The framework report for the common curricular will define the content to be learned in terms of clear, definable criteria of what the student should know and be able to do. It will be student-centered and differentiated, based on students' ability, interests, backgrounds, local culture, traditions, and values.



3 MICROBE COOPERATION FOR INNOVATION AND STRATEGIC PARTNERSHIPS FOR HIGHER EDUCATION FRAMEWORK IO1/A3

The findings of the IO1/A3 and the cooperation for innovation and strategic partnerships for higher education Framework provides significant inputs to the development of a common framework for MICROBE curricula. Preconditions for the change are as follows:



Partner institutions' country reports examined the illustrative policy and planning issues relevant to integrated education on human behavior relevant to influence of coronavirus and negative emotions in a built environment. Gaps in policy planning have also been highlighted on the global scale. Trends, needs and gaps were analyzed and highlighted, as the situation is new and international, proposed suggestions are applicable to every country and elaborate on literature reviews prepared by each partner institution.



Based on the HEI country reports the needs were identified and summarized as follows:

Information, Knowledge and Technology Needs

- Provide HEIs staff with novel educational resources: Computer-based intelligent systems and Software, access to the Internet regardless of the location.
- Provide HEIs staff with adequate training in contemporary hard and soft skillsets.
- Integration of different research areas: built environment, urban planning, human behavior, emotions analytics.
- Integration of adaptive MOOCs, computer learning systems, affective tutoring system, Big Data mining, adaptive examination system, adaptive biometric examination system in the study process.
- Provide HEIs staff with adequate training in contemporary soft skillset (such as communication, flexibility, interdisciplinary teamwork and time management).
- Development of the strategic priorities given to integrated education on human behavior relevant to influence of coronavirus and negative emotions in a built environment at HEI level.

Financial and funding Needs

- Provide sufficient funding for development and integration of new modules and curricula in the field of coronavirus and negative emotions in a built environment.
- Provide sufficient funding for teacher training on coronavirus and negative emotions in a built environment.
- Increased financing for staff training on integrated modules on coronavirus and negative emotions in a built environment.
- Allocate sufficient budget for HEIs for research and innovation activities in the field of the impact of coronavirus and negative emotions in a built environment.

Among these categories' curricular development can be identified as the requirements to be addressed in the content of the MOOC curricular, whereas, research and development, infrastructure development, institutional networking, awareness raising, capacity building, and financial support can be identified as to supporting platforms for the development and implementation of MOOC courses.



4 STAKEHOLDERS' WORKSHOPS (MULTIPLIER EVENTS): DISCUSSIONS OF THE IO1/A3 AND FURTHER RECOMMENDATIONS.

In total 7 European Institutions from Lithuania, Estonia, Spain, Bulgaria, Italy participate in the MICROBE project. Stakeholders' Workshops (Multiplier Events) were carried out in partner institutions during spring-summer 2021.

Since the main objective users of the MICROBE System are residents, governmental institutions and business companies, the project Target Groups' (TG) representatives were involved in the workshop discussions:

- TG 1: Consortium.
- TG 2: teaching staff of universities, public employees, students, graduate students, representatives of non-academic partners of the project.
- TG 3: universities and organizations of partner countries not included in the project consortium.
- TG 4: national and regional authorities, employers and organizations with agreements on employment of graduates.

The purpose of the events was to discuss ideas, opinions, needs and issues of the current state of the education, modules and educational requirements on influence of coronavirus and negative emotions in a built environment (MICROBE). Also findings from the report on current state of higher education and its relationship with humans' behavior on influence of coronavirus and negative emotions in a built environment were presented and discussed: contexts, policies relevant to higher education, and their relationship with human behavior on influence of coronavirus and negative emotions in a built environment, capacity types including institutional capacities, organizational capacities, individual capacities, access to information, knowledge and technology.

The participants of the **VilniusTech** concluded that all participants in the workshop agreed that the workshop was very useful with a productive discussion. Feedback will be taken into consideration for the design of the modules and educational requirements on MICROBE issues, development of MICROBE cooperation for innovation and strategic partnerships for higher education framework and in the same time will be used as targeted dissemination channel regarding the project and its goals.

Built environment topics discussed:

- Working from home is on an upswing; thus, suitable environments must be enabled.
- Pandemics is bound to bring new requirements to future homes.
- Future homes cannot be simply smart homes — they must be healthy and energy-efficient homes.



- Management teams will be designated for infrastructural facilities and different, smaller teams for technical facilities.
- BIM and other digital means need to fight with COVID 19.
- Proptech would change facilities management on a step-by-step basis by employing workplace wellbeing, efficient energy consumption, optimal use of available space and data management.

The topics of the MICROBE MOOC modules discussed:

- Redesign of public spaces to adapt to the uncertainties.
- Social, personal and contextual behavior change and its stages.
- Behavior change at macro, mezo and micro levels
- Behavior change design wheel implementation.
- Sustainable development with respect to COVID-19.
- Analytics tools.
- Supply chain resilient to the current pandemic situation.

Gaps discussed:

- Integration of human behavior relevant to the influence of coronavirus and negative emotions in a built environment as a whole.
- Improvements of soft skills such as communication, flexibility, interdisciplinary team work and time management.
- Improvements of hard skills, such as ICT, data analytics, affective computing, intelligent decision support systems.
- Integration of different research areas: built environment, urban planning, human behavior, emotions analytics.
- Lack of implementation of the latest technologies (adaptive MOOCs, computer learning systems, affective tutoring system, Big Data mining, adaptive examination system, adaptive biometric examination system) in the study process.

Needs discussed:

- New modules in the field of coronavirus and negative emotions in a built environment and these modules integration in existing programmes.
- Trainings for teachers and staff.
- Soft skills, such as communication, flexibility, interdisciplinary teamwork and time management.



- Hard skills, such as ICT, data analytics, affective computing, intelligent decision support systems.
- Integration of different research areas: built environment, urban planning, human behavior, emotions analytics.
- Integration of adaptive MOOCs, computer learning systems, affective tutoring system, Big Data mining, adaptive examination system, adaptive biometric examination system in the study process.

Other topics discussed:

- What small-scale urban interventions in residential neighborhoods would help people feel better, healthier?
- How to ensure the need for social distance in public spaces?
- What are the challenges of urban renewal, conversion (internal development) when a pandemic "pulled" even more people into the suburbs (urban explosion)?
- How to make even better use of e-platforms to involve the public in urban planning, implementation and monitoring?

The results of **Taltech** workshop were organized that every presentation was followed by a discussion session with all stakeholders.

It was agreed that special attention should be paid to strengthening educational and scientific networking among EU universities in the MICROBE education.

MICROBE project should be carried out transnationally to solve the discussed international needs. It was suggested that proposed MOOC modules could be: Simulation of Risk Management Strategies in the Built Environment.

Conclusions after the **ITPIO** workshop were as follows:

- The pandemic is an opportunity to fill in the missing educational needs in terms of dealing with the negative impact of the COVID-19 crisis.?
- There is not an educational initiative on human behavior related to COVID-19 impact by this time.?
- Special attention must be paid to the social-emotional wellbeing of students and teachers.?
- Training of teaching staff on the latest technologies.?
- Training of students on minimizing the influence of COVID 19.?



Italian MICROBE country workshop was divided into 3 phases, the last one was a round table where question were discussed:

1) *How can we design and make the built spaces usable (squares, streets, public buildings, schools, universities, public transport, shopping centers, etc.)?*

As a result of these questions, various inputs emerged from the participants that were reported below:

Value of these spaces and role of the services they can offer:

- During the planning and co-design phases It's necessary to think over how these spaces can also be used in terms of usable services (leisure, nature, sport),
- We must therefore overcome the concept of space as a mere place of living but also conceptualize it in terms of service: think of not working on walls, internal divisions, set-up, but understand how these spaces can be used as services for the citizen. For example, spaces surrounding houses.
- The planning is still too "rigid": the spaces are designed for a certain type of use in the design stage, once they are made they are excessively rigid and instead people and society change faster than these spaces change. We need to solve the flexibility problems that buildings show over time.

New housing needs:

- Restart from existing space and buildings;
- From an urban planning point of view, the pandemic has exacerbated existing problems, highlighted by the transition that is taking place concerning transformation and change of spaces uses;
- As for the growing demand for space and the change in use of spaces abandoned military and railway areas have to be taken into account;
- Take into consideration the importance of sustainability;
- Unpredictability: thinking of a linear development doesn't allow us to consider unpredictable events that require that capacity to react and resilience.

Need for tools that we are no longer used to using:

- New urban planning tools;
- New organizational tools that the Municipality could use to manage urban transformations;

General Urban Plan actions:

- New approaches and choices, due to the pandemic, are needed;
- The issues of habitability and social inclusion are fundamental;



- Participation and co-design processes with citizens have to be prioritized (to be started from existing processes);
- Universal accessibility;
- Re-discuss some cultural behaviors inherent to space perception;

Other aspects to take into account:

- Complex legal and financial issues to review and re-invent
- Spatial aspects to be taken into consideration

Post-Pandemic Reflection:

- Need to plan what will happen next;
- In terms of what will happen, we can consider two models from novels and fiction of the 900:
 - The first is a conservation model, starting from the example of Edgar Allan Poe's "Mask of the Red Death";
 - The second from a post apocalyptic novel, in which humanity is decimated and we rebuild a new society

How do we reorganize this society and how do we design it?

- We need to start from some considerations, such as: public spaces must be conceived and designed by contemplating again the presence of a large number of people (concerts with many people, outdoors market), from this point of view dismissed and underused spaces must be enhanced;
- School spaces have to be rethought with fewer students in the classrooms; rethinking school spaces with distancing but, above all, classrooms with fewer people
- Before planning the new spaces, we need to think about what cultural practices we would like to implement in these spaces
- New places of learning and for teaching, such as the Belluzzi-fioravanti Institute where new spaces were planned and a Community Pact with libraries and museums, as new learning places, were signed;

Mobility

- During the pandemic, reflections focused above all on cycling tools and, in general, on sustainable mobility and Local Public Transport;
- Difficulty in operating and acting due to the conflict between private and public interests;
- It is necessary to intervene with greater propensity for flexibility and lighter on interventions (eg modification of the highway code);
- Quicker to implement and reversible actions;



- Need to deepen experimental approach;
- MAAS: mobility as a service: giving the possibility to those who want to move even without owning a car, can do it more easily;
- Accessibility of new forms of transport alternative to the car make more competitive these new forms of transport (combination of knowledge and access to a mobility service, such as the library booked on the app and geolocated, it's an interesting type of flexibility);
- Mobility is also evolving as a result of changes in lifestyles (consumption, work, free time, etc.).

New way of living the planet through mobility

- We are still not prepared for change. After the reopenings, public space has returned to be planned and lived as a public space to consume (e.g. outdoor tables);
- City must be facilitating, a facilitating environment to allow different uses because it must be taken into account that cities are experienced by communities with different "languages", in terms of ways to use it and to express themselves;
- Solarpunk is mentioned (a cultural and artistic movement that promotes an optimistic and progressive vision of the future, with a particular focus on renewable energy and new sustainable technologies):
 - abandon dystopia
 - different rewriting of the imaginary of space
 - look for new different forms of housing (look for new tools in space)
 - open to languages
 - construct the space in a different way (constructive)

2) *What are the targets to involve and what are the more appropriate tools to train these spaces planners (urban planners, architects, public officials, stakeholders, etc.)?*

Planners

- Public and private architects: there are critical issues regarding cultural aspects, especially when it's time to turn an expansive project to a regenerative one (urban planners are very "bewildered" on this scenario)
- Need for training for administrators and town planners

Designers

- It's necessary to plan by improving listening skills
- Accessibility: the proposals on this issue are still affected from a partial point of view
- Little attitude to monitoring and evaluating projects carried out and if they meet the needs

New tools



- Activate an integrated process (architects, artists, etc...): New Bauhaus, in that sense, is an example of multidisciplinary;
- Forms of evidence - data, opinions, proves;
- Working on procurement policies;
- Tools to collect experimentation changes;

Difficulties concerning tools (not flexible)

- Training also for those who will live in the future space
- Difficulty also internally (Municipality)
- Involve technicians and users
- Internal training of the Municipality: making these courses more functional to the needs, in particular those regarding Municipality public officials

3) *What are the targets to involve and what are the more appropriate tools to train these spaces users (students, pupils, children, citizens, consumers, public employees, etc.)?*

Students (e.g. Belluzzi Institute - Borgo Panigale - Reno)

- Tools to improve the use of time
- Access to services can increase use and opportunity
- Take into account the potential of technological and IT tools

Public employees and planners

- Educating the imagination and reading the present with the eye of change
- Skills also in terms of empathy
- Participatory processes training
- Get known of the public training needs

4) *What value can it have and how it is appropriate to detect the emotions of the people who use the built Spaces?*

Perceptual and emotional aspects

- Grasping and capturing the emotional perceptions of people who have had various problems working at home (e.g. depressive symptoms), during this pandemic period;
- There were several symptoms at depressive - physical level and understand from this how to review the spaces and arrange the working space.
- It's important to detect people's emotions to study well-being and bring it back to the level of space.

In this regard, two Administration projects, with FIU as partner, are mentioned:

- Extra Project: main issues the 15 minutes city, accessibility and space;
- Biennial on public space;



The purpose of both projects is to survey and monitor the effects of the modification of the public space.

Take emotions into account

- Releasing emotions in the relational context
- Need for mediation - measurement
- Effectively understand the use of the workspace
- Understanding how covid has affected people's mental health
- Detachment between people and space

Take into account the most fragile subjects

- Engagement with the most fragile people
- Effect on children - most affected victims of this pandemic
- Affective and psychological problems

University of Granada prepared a report as a part of ***the Intellectual Output 2 IO2/A2 Analysis of former concepts, models, methods, and theories of MICROBE*** based on the result of the workshop, where several experts from different research fields have participated giving their opinions on the topics related to the thematic related to the MICROBE project. This workshop is divided into three parts associated with the aforementioned project, the past, the present and the future related to the coronavirus.

This report has focused on the behavior of society towards the coronavirus. This is fundamental for the prevention of a possible pandemic, as by knowing how the population behaves, it is possible to apply certain rules, laws and measures, which the population will get right and which rules should be put in place that will not be accepted by society in a possible pandemic. This is a great step forward, as knowledge of society is an important factor in preventing certain behaviors that may favor the spread of a virus. However, society has learned behaviors from Eastern societies and has implemented measures that have not only prevented the spread of the coronavirus but have also meant that influenza, which has a seasonal period, has decreased considerably in the world. Consequently, sanitary measures, such as wearing a mask, have become something not only typical of Eastern societies but also of the countries of the world.

During the workshop, it was possible to appreciate the different points of view of experts from architecture to medicine. This led to the various conclusions that will be discussed below. The first conclusion is that society was not prepared for the pandemic, even if it had not been warned in time, because it was thought that pandemics were things of the past. Another conclusion is that we have learned to value and make the spaces associated with our home more flexible, as a terrace or balcony can be an exit to the world and the enclosure of a terrace to have more space inside can be



a mistake. Furthermore, homes have gone from having places of limited activities to places of sensations, because a living room can be a place for family gatherings and a bedroom a place of intimacy. The next conclusion that can be drawn is that previous research into the SARS virus and high funding has led to a vaccine being found in record time. However, past behaviors have not helped the population to cope with the pandemic. The reason for this is as mentioned before, society thought it was something from the past and had nothing to do with today's society and was more associated with past western societies or eastern societies. Conclusions that can be drawn from the present is that society has changed the habits and behaviors of today's population, but it is too early to say which changes will be permanent and which will be temporary. Another conclusion that can be drawn from the workshop, for the present part, is that the pandemic has boosted an element that was already growing, digitalization. Digitalization has enabled the economy, social relations, entertainment, etc., to change. This has meant that the associated economic crisis that we are currently experiencing would not have been exacerbated in comparison to the economic crisis that all countries are experiencing. Finally, the last conclusion drawn from this part is that it is easy to create a destructive policy or to find out which measures have been right or wrong after a while, but it is complicated when rules have to be made in the middle of a problem. Therefore, the only problem that would have been reprehensible would have been not to have taken any health measures to try to save lives.

The last part of the workshop has led to different conclusions. The first of these is that European measures to rescue Eurozone countries from the economic crisis associated with the coronavirus are associated with measures that imply that Spain's economic model should be modified and be based more on a model based on industry and less on tourism. On the other hand, it can be concluded that public sectors that have been strengthened during the pandemic have been beneficial for the population and that sectors that had suffered cutbacks in the past have suffered during the pandemic. Consequently, public sectors should be strengthened for the benefit of the population. Concerning future pandemics, the experts concluded that climate change will be responsible for future pandemics because as temperatures rise, viruses found in specific areas will spread. Finally, the experts concluded that the pandemic has changed society as a whole, its behaviours and the way it interacts with other people. However, it is too early to know whether societies have evolved positively or negatively, but what they do agree on is that they have evolved.

Finally, the experts' conclusions were supported by a survey of Spanish society. Two hundred and fifty-three people took part in this survey and responded to the questions put to the experts employing a numerical evaluation survey. The results obtained are similar to those of the experts, even in the questions where they did not have a consensus. Consequently, it can be concluded that the experts and society are in harmony to have a better future for all people in the world, and therefore, governments must listen to the experts and societies to achieve a more beneficial future



for all, a society that is not destructive but rather one that coexists with the rest of the living beings on the planet.

5 PROPOSED MOOC MODULES

Megahed and Ghoneim (2020) argue that architectural and urban spaces, as they relate to infectious disease epidemics, are not only about quarantine based on immediate and precautionary measures but also refer to design and planning problems and challenges in all building types and urban spaces as illustrated in Figure 2. The pandemic of COVID-19 has caused serious consequences that can be an opportunity to review individual and collective choices and priorities.

Most architecture today shows evidence of how humans have responded to infectious diseases by redesigning our physical spaces. Thus, social distancing could change the design and planning process (Budds, 2020; Chang, 2020), specifically with the increased acceptance of distance learning, online shopping, and the cultural connection of online entertainment. The use of media for information sharing, and webinars for sharing knowledge and expertise have seen widespread adoption during the COVID19 pandemic (Chick et al., 2020; Goniewicz et al., 2020).

Although new technologies can create additional difficulties, opportunities have emerged to apply innovative solutions to more smart and virtual world applications in the built environment. When we increasingly work from a remote location, learn and upgrade skills online and shop for necessities from e-commerce sites, we reduce the need of traditional physical spaces by virtual digital ones which can be accessed from smart devices (Goniewicz et al., 2020; Hishan et al., 2020; Papu & Pal, 2020). According to the affected lifestyles, the increased reliance on digital channels in the built environment may endure long after the pandemic and affect in every design and urban aspects. Humanity is facing a global crisis, perhaps the greatest of our generation.

Many measures adopted during the emergency will become part of daily life, changing habits, and behaviors, they may be a positive or negative intervention in architecture and urban planning approaches. While there are many potential impacts of COVID-19 on built environment, our focus in the following points is on how post-architecture may change. Although social distancing and quarantine measures are extensively adopted as the first preventive measure, other factors increase the risk of contracting the virus, as discussed below.

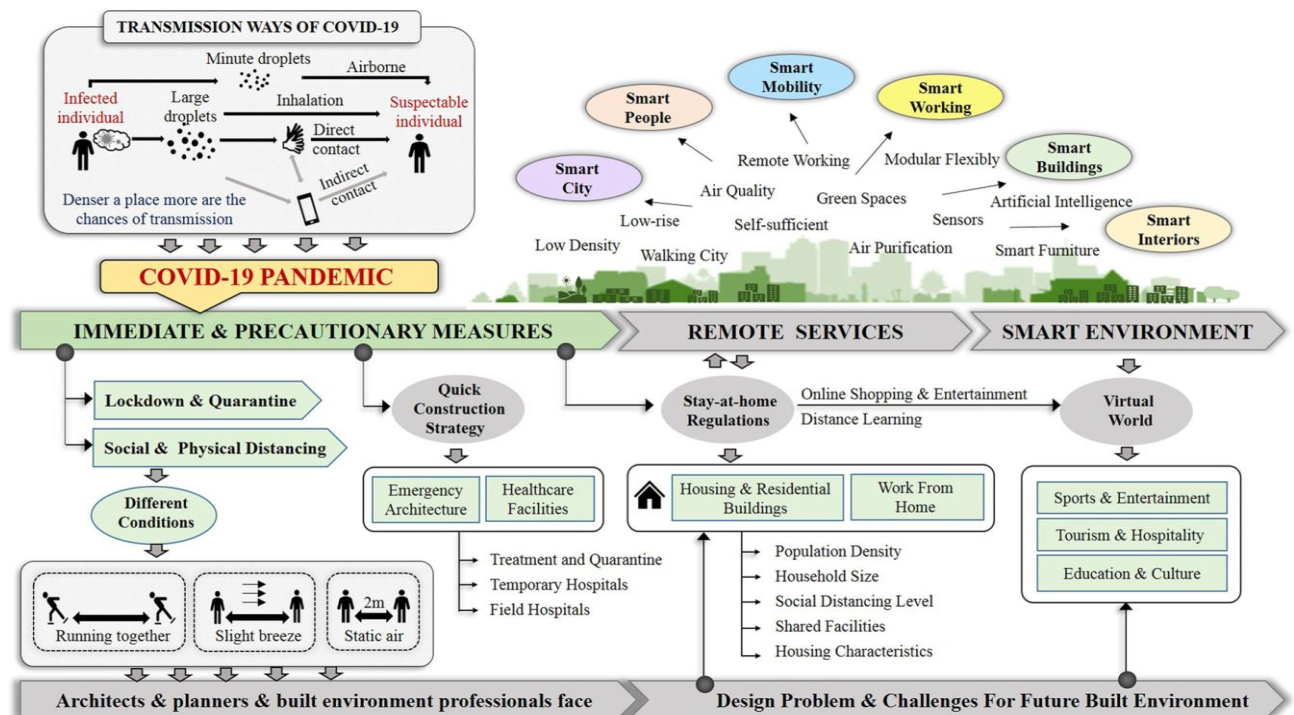


Figure 2. Social distancing and lockdown reflections and their links to the variables under research. (Megahed and Ghoneim, 2020)

In formulating the learning objectives for the MOOC modules, it is recommended to adopt the Bloom's taxonomy with reference to the level of proposed programme. The remember, understand, and apply stages are most suitable for the bachelor's level courses where the analyze, evaluate and create levels are most suitable for the postgraduate level courses. The objectives can be developed aligned to the taxonomy recommendations following a gradual advancement towards the application to maintain the comprehension and consistency of the objectives.

Pedagogical framework is designed to support teachers in the delivery of quality teaching and learning that will improve student learning. The open pedagogy promotes dynamic, and innovative learner-generated content design. Open methods of communication and interaction are used within a global community of learners who provide peer support and review. The PCHEI can benefit from each other based on the available potentials and partnerships.

To ensure the quality of adaptive MOOCs, Manual for Quality Assessment for E-learning (2012) by European Association of Distance Teaching Universities (EADTU) and OpenupEd quality benchmarks are suggested to be used. The OpenupEd consists of a framework of common features for MOOCs that puts the learner at the center in the teaching and learning process. The key aspects of the framework can be followed by each PCHEI in order to maintain the consistency and standards in the



MOOC courses (Learner-centered, Openness to learners, Digital openness, Independent learning, Media-supported interaction, Recognition options, Quality focus, and Spectrum of diversity).

It was agreed that special attention should be paid to strengthening educational and scientific networking among EU universities in the MICROBE education.

MICROBE project should be carried out transnationally to solve the discussed international needs.

Due to partner institutions' extensive experience in such research fields as: multivariant simulation modelling of management strategies in construction, impact of climate change, disaster resilience, big data analytics, smart buildings, BIM, nearly-zero energy solutions, etc., it was suggested that proposed MOOC modules could be:

Simulation of Risk Management Strategies in the Built Environment
SMART Built environment
Post-pandemic buildings renovations
Post-pandemic Urban Planning
Adapting office spaces to the post-pandemic requirements
Post-pandemic urbanism
Adapting public spaces to the post-pandemic requirements
Adaptive reuse
Engineering response to the post-pandemic requirements
Building and construction technology in the post-pandemic times
Smart cities and analytics
Changing role of disaster risk management
Digital transformation of the construction industry in the post-pandemic world
Change management
Centralization and decentralization of the urban space
Renewal of the building standards to fit the post-pandemic requirements
Flexibility and transformation as the new requirement for architecture and engineering
Chemical engineering and new building materials
New level of prefabrication and standardization of components
Cognitive sciences and the build environment



6 BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES – COGNITIVE DOMAIN

Bloom's Taxonomy of educational objectives – cognitive domain (1956) was used as the theoretical framework for this analysis. Bloom's Taxonomy of educational objectives is arguably one of the most influential educational monographs of the past half a century. That it has stood the test of time in the educational setting is testament to its contribution to the education community (Marzano and Kendell 2007).

The cognitive domain is divided into the following objectives: knowledge, comprehension, application, analysis, synthesis and evaluation, in which knowledge is the lowest form of cognitive thinking and evaluation is the highest (See Figure 1). Similar to other taxonomies, Bloom's is hierarchical; meaning that learning at the higher objectives is dependent on attaining prerequisite familiarity and skills from the lower objectives of the taxonomy (Orlich et al. 2004). A student functioning at the application objective has usually mastered the material from the knowledge and comprehension objectives.

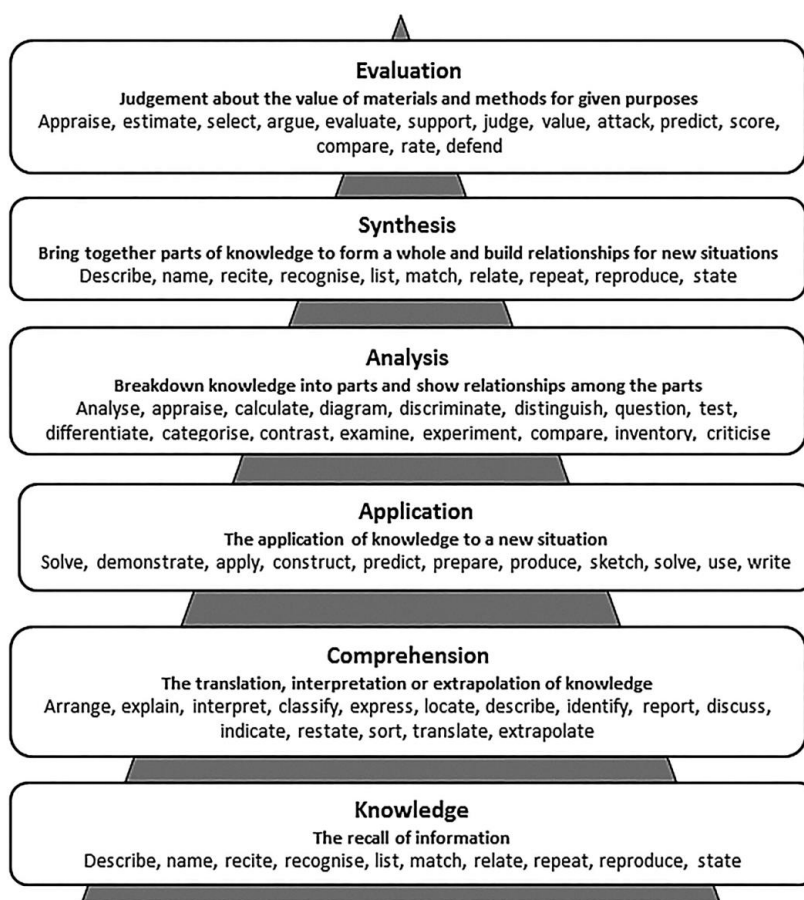


Figure 1. Bloom's taxonomy of educational objectives: cognitive domain (1956) with associated verbs



Bloom's taxonomy is a powerful tool to help develop learning objectives because it explains the process of learning:

- Before you can understand a concept, you must remember it.
- To apply a concept you must first understand it.
- In order to evaluate a process, you must have analyzed it.
- To create an accurate conclusion, you must have completed a thorough evaluation.

Bloom's Level	Key Verbs (keywords)	Example Learning Objective
<i>Create</i>	design, formulate, build, invent, create, compose, generate, derive, modify, develop.	By the end of this lesson, the student will be able to design an original problem-solving principle of CCA into DRR.
<i>Evaluate</i>	choose, support, relate, determine, defend, judge, grade, compare, contrast, argue, justify, support, convince, select, evaluate.	By the end of this lesson, the student will be able to determine appropriate CCA actions for effective DRR implementation.
<i>Analyze</i>	classify, break down, categorize, analyze, diagram, illustrate, criticize, simplify, associate.	By the end of this lesson, the student will be able to differentiate between CCA actions and DRR strategies.
<i>Apply</i>	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, perform, present.	By the end of this lesson, the student will be able to define CCA actions in DRR.
<i>Understand</i>	describe, explain, paraphrase, restate, give original examples of, summarize, contrast, interpret, discuss.	By the end of this lesson, the student will be able to describe CCA and DRR in her/his own words
<i>Remember</i>	list, recite, outline, define, name, match, quote, recall, identify, label, recognize.	By the end of this lesson, the student will be able to recite climate change adaptation (CCA) into disaster risk reduction (DRR).



Table 1. Learning objective examples (adapted from, Nelson Baker at Georgia Tech: nelson.baker@pe.gatech.edu, <https://tips.uark.edu/using-blooms-taxonomy/>)

Steps towards writing effective learning objectives (adopted from Using Bloom's Taxonomy to Write Effective Learning Objectives | Teaching Innovation and Pedagogical Support <https://tips.uark.edu/using-blooms-taxonomy/>):

1. Make sure there is one measurable verb in each objective.
2. Each objective needs one verb. Either a student can master the objective, or they fail to master it. If an objective has two verbs (say, define and apply), what happens if a student can define, but not apply? Are they demonstrating mastery?
3. Ensure that the verbs in the course level objective are at least at the highest Bloom's Taxonomy as the highest lesson level objectives that support it. (Because we can't verify they can evaluate if our lessons only taught them (and assessed) to define.)
4. Strive to keep all your learning objectives measurable, clear and concise.

7 GENERAL COMPONENTS OF THE PEDAGOGICAL PRACTICES

Pedagogical framework is designed to support teachers in the delivery of quality teaching and learning that will improve student learning (Hegarty, 2015). The model resource includes information on getting started with using the model to plan, reflect upon and improve teaching practice. The components in the pedagogical practice provide the guide to consider the potentials within the PCHEI into the development and improvements in the MOOC curricular development and identify their potentials to support the PCHEI in need of the development support.

The components can be identified as mentioned below:

1. Participatory Technology

Ensure critical approaches to knowledge with user participation. Supporting personalized learning.

2. Innovation and creativity

PCHEI should attempt to produce and practice new technologies including E-learning. Availability of Technical Support Centres.

3. Reflective practice

The access to state-of-the-art technology should be carried out through bibliographical and regulatory research. The MICROBE MOOC module guides could be used in constituting new online courses.

4. *Learner Generated*

Providing ways for learners to promote and share their work.

5. *People, openness, trust*

Ensure the competencies in open and network literacy. Implement modern technological solutions in the curricula.

6. *Sharing ideas and resources*

PCHEI should be benefited from MICROBE project in preparing and sharing MOOC modules. Ability to share the skills and expertise regarding the access to state-of-the-art technology.

7. *Connected communities*

The international dimension of the project can guarantee a wide diffusion, which could also become attractive for other countries.

8. *Peer review*

Previous experiences on similar projects and lessons learnt. Foster collaboration and peer review.

8 OPENUPED QUALITY BENCHMARKS FOR MOOC CURRICULAR DEVELOPMENT

To ensure the quality of adaptive MOOCs, special guidelines and accreditation rules will be developed and adopted in each participating PC university. For this purpose, Manual for Quality Assessment for E-learning (2012) by European Association of Distance Teaching Universities (EADTU) and OpenupEd quality benchmarks (<http://www.openuped.eu/>) will be used (European Association of Distance Teaching, 2012).

The OpenupEd consists of a framework of common features for MOOCs that puts the learner at the center in the teaching and learning process. Following are the key aspects of the framework.

- Learner-centred
- Openness to learners
- Digital openness
- Independent learning
- Media-supported interaction
- Recognition options
- Quality focus
- Spectrum of diversity

1. Learner-centered

MOOCs should be designed such that all unnecessary barriers to learning are removed, while aiming to provide students with a reasonable chance of success in an education. But that goes beyond offering a course freely online, even if they are in the local language. In open education we should also have a learner centered approach. I.e. we should focus more on innovations in open pedagogical thinking and less on technology and platforms.

Courses should aid students to construct their own learning from a rich environment, and to share and communicate it with others; they should not simply focus on the transmission of content knowledge to the student.

Openness in education is also about the learned centred activities, which are carefully designed by the teaching staff. Here, the core question is "how does good learning proceed as a process" in a potentially rich environment.

2. Openness to learners

This captures aspects such as: open entry (no formal pre-requisites), freedom to study at time, place and pace of choice, flexible pathways, suitability for a wide variety of lifelong learners. In a broader perspective this feature stresses the importance of being open to learners' needs.

Massive Open Online Courses should be designed as open as possible, in such a way that all unnecessary barriers to learning are removed, both at the entry into learning and along the learning path.

The following dimensions have been introduced:

Free of charge: Full course experience for free-of-charge. For additional services, like personal tutoring or doing a formal exam for obtaining an ECTS certificate, there will be some cost involved.

Free admittance: An open entry policy is applied. Anyone can basically participate regardless of prior education. However, that does not imply that MOOCs are only offered at novice level. All MOOCs require some basic skills of ICT and language skills. And there are courses that require extensive prior knowledge and skills. But these knowledge and skills are not tested beforehand, nor are any formal qualification needed to enter the course.

Open Accessibility: Course can always be accessed by anyone anywhere if they have an internet connection.

Learn anywhere online: The freedom of place to study at home, at work, at a library, virtual classroom, on a train or a plane, abroad, on a boat etc.

Start anytime: Begin a course at any point during the year and study at any time.



Self-paced: Determine the own pace and schedule. Self-paced MOOCs will need to be finished with recognition and consequently have an end date (set by the learner).

Open programming: The programmes involve certain freedoms as regards their content and order; Necessary combine modules/courses can be undertaken. There are partial programmes and complete open programmes available.

In a broader perspective this feature stresses the importance to be open to learners' needs. I.e. education should be affordable, rewarding, good quality, feasible, enjoyable, but also with freedom of time / pace / place, open entry, open programming, credentialing, bridge between formal and informal learning, lifelong learning.

3. Digital openness

Courses should be available online for free but in addition apply open licensing so that material and data can be reused, remixed, reworked and redistributed (e.g. using CC-BY-SA or similar). Learner-centred approach Courses should aid students to construct their own learning from a rich environment, and to share and communicate it with others; they should not simply focus on the transmission of content knowledge to the student.

Digital openness has various domains to which it can relate; open source (for software), open access (for scientific output), open content, open educational resources (for learning materials). A central issue to all these forms of digital openness, in contrast to standard copyright, is that it is free available and has an open license. For open content and open educational resources Creative Commons has developed a system of open licenses which are fit to different circumstances and which are meanwhile commonly applied.

Open licence: (re-)use. The user has the rights to reuse, revise, remix, and redistribute content or courses. The open licence is an important business driver for promoting skills, enhancing knowledge transfer and increasing the pace of innovation.

The OpenupEd aims to be in these 5R' domains of the digitally open world (Retain, Reuse, Revise, Remix, Redistribute) as much as possible. As a rule, the OpenupEd courses should be openly licensed, for example CC BY or CC BY SA.

4. Independent learning

A MOOC should provide high quality materials to enable an independent learner to progress through self-study.

In higher education students usually are guided throughout the curriculum by teaching staff in classrooms, by books and readers and in virtual learning environments. A MOOC, however, should provide high quality materials and a rich learning environment to enable an independent learner to progress through self-study.



Built-in support & tutoring. Since independent learning is the ‘holy grail’ of higher education, built-in guidance is needed to optimize the learning process and to support you for learning on your own. As such, the user will become a more independent learner and will need less guidance than in the first courses. Independent learning is also essential to move forward in the further academic or professional development in life. Personal tutoring is optionally available with some courses.

5. Media-supported interaction

Course materials should make best use of online affordances (interactivity, communication, collaboration) as well as rich media (video and audio) to engage students with their learning.

6. Recognition options

Successful course completion should be recognised as indicating worthwhile educational achievement.

OpenupEd partners offer a full/complete course experience including informal recognition options for free. Moreover, MOOC participants should be offered a pathway to formal higher education and as such should also be offered the possibility to a formal credit (to be paid for).

In addition, the majority of OpenupEd MOOCs provide the possibility to obtain a formal certificate, i.e. official credits that can count towards obtaining a degree, i.e. ECTS (European Credit Transfer and accumulation System).

Full Course Experience: MOOCs is identified as a complete course experience including:

- educational content
- facilitation interaction among peers (including interaction with academic staff)
- activities/tasks, tests, including feedback
- some kind of (nonformal) recognition options
- a study guide / syllabus

The total study time of a MOOC is minimal 1 ECTS (typically between 1 and 4 ECTS).

7. Quality focus

There should be a consistent focus on quality in the production and presentation of a MOOC. A high-quality course is essential for an optimal chance of study success. OpenupEd aims to be a distinct quality brand embracing a wide diversity of (institutional) approaches to open education via the use of MOOCs. Therefore, OpenupEd partners may agree that the quality process should be one that is tailored to both e-learning and open education.

The quality of our MOOCs is assured on three levels.

Quality assured: Every OpenupEd partner has an internal Quality Assurance system in place to approve a MOOC and apply the OpenupEd Quality Label.



Accredited: OpenupEd MOOCs are also part of an accredited curriculum and as such (part of) the course is subject to the national quality system (e.g. national accreditation organisation).

EFQ level: For all courses, the EQF level is indicated.

In short: OpenupEd provides you with real opportunities to participate in higher education and provides quality learning opportunities to all.

8. Spectrum of diversity

A course should be inclusive and accessible to the wide diversity of citizens. OpenupEd MOOCs can be used in local case studies embracing the diversity in institutional approaches to open education using MOOCs.

OpenupEd supports diversity: a course should be inclusive and accessible to the wide diversity of citizens. In short: it should appeal to everyone. As stated earlier it's all about putting the learner at the center.

Diversity: OpenupEd cherish diversity in languages and cultures, a spectrum of approaches and contexts, accounting for variety and profiling. Diversity as one of the key advantages of new learning technologies.



9 COMMON FRAMEWORK FOR MICROBE CURRICULA

Requirements must include sufficient funding for:

Curricula development

Teachers and staff trainings

Novel educational
resources

ICT incorporation into the
learning environment

Training and pedagogic practice in integrating education with human behaviour relevant to influence of coronavirus and negative emotions in a built environment





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