



Erasmus+

MAPPING THE EXISTING  
PARTICIPATORY PRACTICE  
AND MODELS OF  
RE-PURPOSING  
EDUCATIONAL BUILDINGS  
AND SPACES



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## INTRODUCTION

Student centered learning (SCL) is becoming a cultural shift in higher education aimed at adapting it to increasingly diverse student populations across higher education institutions (HEIs) across the EU. As students with diverse needs, learning styles, and experiences continue entering higher education, teaching and learning methods used in HEIs shift as well. While difficult to describe and often misunderstood as aiming to completely abolish traditional teaching methods, at its core SCL couples the perspectives of individual students with teaching methods that most actively promote motivation, learning, and achievement. In SCL, active learning methods, as well as inclusivity, flexible learning, technology assisted learning, and community engagement are pivotal approaches that guide practical applications across HEIs.

Student centered-learning sprawls across multiple dimensions: in this project, we focus on learning methods, information and communications technology (ICT) and digital learning, and the design of physical spaces, with a particular focus on the ways educational spaces can be repurposed to become student centered. This summary introduces SCL and a concept and its origins, then discusses most influential SCL methods currently used in practice, also relating it to learning ergonomics and the importance of space in approaching SCL. Furthermore, normative and legislative environment for introduction of SCL across HEIs in the EU is discussed. Then, some practical examples of teaching materials that encourage active learning (such as independent study modules, research projects, and self-initiated assignments ) are presented, as well as five universal principles for strategic interior design to make spaces more student centered: flexible spaces, encouragement of collaboration, tech-friendly solutions, improving student comfort and focus, and connecting study spaces to public spaces. Practical examples of existing good practices in HEIs are then discussed using spaces from University College of Northern Jutland (Denmark), Alpen-Adria University Klagenfurt (Austria), and IE University (Spain). In addition, principles and good practices from creative hubs, such as openness, encouraging collaboration, and community-centered approach, are discussed as something that can be applied to HEIs to make their spaces more student-centered.

The present research is twofold: firstly, an analysis of the best digital tools used for online education is presented. Most popular platforms used in higher education to supplement SCL, i.e. Microsoft Office (and MS Teams), Zoom, Moodle, BigBlueButton, and Adobe Connect, their advantages and drawbacks are discussed. Furthermore, the impact of COVID-19 and digital learning on practical disciplines, e.g. health and natural sciences, is considered. Secondly, the last part presents findings from two focus groups conducted with students at University of Ljubljana in Slovenia (UL) and Vytautas Magnus University in Lithuania (VMU). Focus group analysis enables comparisons between theoretical knowledge towards student-centered

environments and actual expectations of the students. Furthermore, it allows to make recommendations and conclusions based on qualitative data collected from those intimately familiar with the physical and digital spaces of universities, creating a productive feedback loop. The goal of focus groups was to assess the actual stakeholder needs concerning student-centered learning environments, and the primary target audience of the focus groups were students that are familiar with university territory (buildings, spaces, facilities, etc.) and can comment on the context and character of existing learning environments.

The research groups reached out to several groups of students, in order to bring different perspectives and ensure maximum information gain from the focus groups. The focus groups were held via Zoom and the sessions were recorded (with prior consent from the participants). The focus groups started with a short presentation of the researchers and the main aims of the project as a whole. Participants were then given the opportunity to shortly introduce themselves and their background relevant to the focus groups. The focus group questions were shown as a PowerPoint presentation through the 'Share Screen' function on Zoom. The focus groups lasted approximately an hour and a half without any interruptions. Participants were given the chance to discuss questions between themselves. The researchers intervened only when the conversation had drifted too far from the original question, and to pose additional questions. All participant identities were later anonymised and this summary presents findings in a general way, so as to protect participant confidentiality.

Finally, conclusions and recommendations from the findings of background and current research are made in order to make steps to make higher education curricula and HEI spaces across the EU more student-centered and comfortable for students with various learning styles, experiences, and abilities.

## BACKGROUND

### The concept and principles of student-centered learning (SCL)

Student-centred learning (SCL) is becoming an important aspect of all types of educational institutions. While SCL is somewhat difficult to define in terms of its methodology and explicit content, which is to be included, it is the key to adapting higher education (HE) to a more diverse student population and changing in terms of how education is conveyed. It would be more prudent to think of SCL as a cultural shift in educational institutions. It is often misunderstood that the purpose of SCL is to completely abandon traditional forms of HE teaching. They are still a key point of teaching in terms of offering the overview of a discipline. The historical roots and theoretical perspectives on SCL are such that the concept builds on various theories, learning models and principles from experiential learning to humanist and critical perspectives, constructivist theories, active learning and andragogy.

Up until the 20<sup>th</sup> century the teaching environment resembled the industrial economy, since the main purpose was to deliver a message to a large group which sat in silence, listening and taking notes (Cornell, 2002). A definition of SCL, put forward by McCombs and Whisler (1997, p. 9), has been widely used and encompasses the major parts of the concept:

“the perspective that couples a focus on individual learners (their heredity, experiences, perspectives, backgrounds, talents, interests, capacities and needs) with a focus on learning (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, learning and achievement for all learners).”

The industrial economy has now given way to the so-called ‘knowledge economy’, in which economic power resides in knowledge, networks and relationships. Over 59 percent of the workforce consists of knowledge workers, whose raw materials are knowledge and information (Cornell, 2002). Work surrounding SCL has been built over the past decades and took prominence in the field of education due to 20<sup>th</sup> century educators. One of the original educators credited with SCL was Hayward in the 1950s and the concept later appeared in Dewey’s work in 1956 (EHEA, 2010). It was also inspired by political movements, which accompanied the massification and diversification of HE as a diverse student body entered higher education institutions (HEI) (Scottish Funding Council, 2006; Hoidn and Reusser, 2020).

The concept underpinning 'student-as-producer' is that learning is grounded in research and research-like activities, so much of what the student learns will be through their own discoveries, working in collaboration with academic advisers and

other students in a supportive research-rich environment (Hynes: 2017, Abu Bakar et al.: 2013). During the course of teaching, most teachers will have a clear idea of what the students should learn. However, there is a need to distinguish between declarative knowledge and functioning knowledge. When it comes to it, declarative knowledge is usually second-hand, it is about what has already been discovered. Knowledge of academic disciplines is declarative and students need to understand this in order to later be capable of transforming declarative knowledge into functional (Biggs, 2003). This approach has many implications for the design and flexibility of curricula, course content and interactivity of the learning process and is being increasingly used at universities across Europe (EHEA, website).



The European Higher Education Area (EHEA) notes, in its *Toolkit for students, staff and higher education institutions*, the following principles, which underline SCL:

1. SCL requires an ongoing reflexive process: teachers, students and institutions have to continuously reflect on the systems in place
2. SCL does not have a 'one-size-fits-all' solution: all actors and contributors to the education system are different and therefore adaptation has to happen on a rolling basis
3. Students have different learning styles: different learners and students come with diverse pedagogical needs.
4. Students have different needs and interests: needs and interests are not limited to the classroom and should be treated as such.
5. Choice is central to effective learning in SCL: within (higher) education choice can be given in a number of formats.
6. Students have different experiences and background knowledge: adapting to the skills set, which students present at the beginning of a course
7. Students should have control over their learning: giving students the opportunity to be involved in the design of their own learning
8. SCL is about 'enabling' not 'telling': with the SCL approach gives the student greater responsibility
9. Learning needs cooperation between students and staff: can lead to faster and more efficient solving of problems and proposing solutions (EHEA, 2010; ESU, 2015).

Recent literature in pedagogics suggests that learning effects are highest where students are engaged in active learning. In order to prepare for student-centred learning, HEI should be engaging students from the beginning of their university studies, make students part of the course development processes, integrate courses on academic skills in the curricula, offer training programmes for tutors, offer courses on learning theories and good practices for students and teachers, and engage students in research projects (European University Association, 2017). When it is properly structured, SCL can lead to increased motivation to learn, greater retention of knowledge and academic performance, deeper understanding, more positive attitudes towards the subject and learning in general (Hoidn and Reusser, 2020).

The process of making graduates and citizens is an experimental continuum, allowing universities to provide conditions for associational activities as well as perform a role of cultural custodians by maintaining and revitalising cultural inheritances of the political community, but also giving it direction. It is important to realise that HEI should not aim to undertake such activities on their own, rather they should seek assistance from local and regional experts in the field of pedagogics, urban methodology and cultural activities. Organisational change towards SCL (and teaching) can also be driven or at least supported by governmental policies and instruments. Students need to be empowered to take more active roles in their education (see EUA, 2017a, 2017b, 2017c; Hoidn and Reusser, 2020).



## Pivotal and most influential SCL methods, approaches and strategies

The methods of SCL have the potential to establish deeper and more meaningful learning (Hoidn and Klemencic, 2020). As mentioned above, the aim of SCL is not to entirely abandon the practice of lecturing and methods of instruction, which are largely associated with low student interaction. Foundational knowledge, especially in disciplines which are entirely or partially new to students, require teacher-centred learning, in order to establish a basis for future learning and teaching.

While there is a time and a place for the lecture strategy, the same can be said for active learning. Active learning, highly associated with SCL, has been demonstrated to promote higher level learning, critical thinking, enjoyment and engagement. In the beginning, most of active learning was limited to laboratory and scientific practice work, therefore natural sciences and scientific disciplines (Hoidn and Reusser, 2020). Methods and approaches to SCL largely include ways of teaching and instruction, where students are actively engaged in the course of each learning session. Research has shown that most students' concentration lasts only about ten to fifteen minutes (Bligh, 2000; Middendorf and Kalish, 1996). Below, the table shows a list of examples of student-centred learning/teaching methods.

Outside of the lecture format	In the Lecture
Independent projects	Buzz groups (short discussion in twos)
Group discussion	Pyramids/snowballing (Buzz groups continuing the discussion into larger groups)
Peer mentoring of other students	Cross-overs (mixing students into groups by letter/number allocations)
Debates	Rounds (giving turns to individual students to talk)
Field-trips	Quizzes
Practicals	Writing reflections on learning (3/4 minutes)
Reflective diaries, learning journals	Student class presentations
Computer assisted learning	Role play
Choice in subjects for study/projects	Poster presentations
Writing newspaper article	Students producing mind maps in class
Portfolio development	

Source: O'Neil and McMahon (2005) 'Student-centred learning: What does it mean for students and lecturers?' in O'Neil, G., Moore, S., McMullin, B. (eds) *Emerging Issues in the Practice of University Learning and Teaching*. Dublin: AISHE.

SCL can encourage inclusiveness in higher education through inclusive curriculum and pedagogy (diversifying course materials and teaching strategies), flexible learning pathways (allowing students to choose the most suitable subjects to study and



personalised ways to engage in learning), technology-enhanced learning (enabling distance learning), learning support (ensuring students do not drop out), teaching support (offered to instructors to ensure courses are inclusive), inclusive learning spaces and libraries (enabling mobility and access to learning resources, including students with disabilities) and community engagement and collaborations between higher education institutions and community partners (providing effective ways to reach regional or local communities) (Klemencic, Pupinis and Kirdulyte, 2020: 8-9).

For example, Vytautas Magnus University bachelor's and master's study programs include internships, research and final theses, which require working in groups, problem-based learning skills, data of interdisciplinary research, spaces where research could be conducted, students' ideas can be tested in order to bring together students from different fields of study to solve a problem. In addition, *Academia cum laude* functions as a university inside the university: highly qualified professors, selected from all faculties create the necessary conditions for students who have won the enrolment competition to design their individual study plans from courses offered at the university. Students of the academy study on the basis of a minor study program in parallel with their major studies. Students can choose courses on the principle of *artes liberales* (liberal arts) and over the whole study period work with the preferred tutor who is a professional in the field, a top international scholar, researcher or recognized artist.

Another example comes from McGill university in Canada, where a change in the allocation of funds also somewhat changed the strategy of teaching and allowed a refocusing on active learning. Among the focus points for the University were academic challenge (focused on higher-order thinking and reflection), learning with peers (collaborative learning with diverse others), experiences with faculty (effective teaching practices and interaction with faculty), the campus environment (a high-quality supportive environment) and high-impact practices (practices that expand beyond the conventional university curriculum including field experiences, internships and study abroad programmes). The University also decided to take on some restructuring of the physical space including using larger (round) tables, modern audio-visual systems, moveable chairs, eliminating a clear front of room, etc. (Finkelstein and Winter, 2020).

While there is literature about the impact of SCL and active learning on students, less research has been done on the impact of these methods on instructors and teachers. This should not be underestimated, since readiness to participate in active learning should be present on both sides (Finkelstein and Winter, 2020).

### SCL and the element of space (learning ergonomics)

Alongside student-centred learning, educationalists and experts in pedagogics have focused on learning ergonomics as one of the key aspects of providing a cohesive and welcoming learning environment. The aim behind learning/teaching environment design focuses on being user-centred. SCL and learning ergonomics intertwine since one will necessarily inform the other. If students are placed in charge of their learning

and teaching process, they will use space and parts of their environment differently, compared to when the interactions were dictated solely by the instructor/teacher.

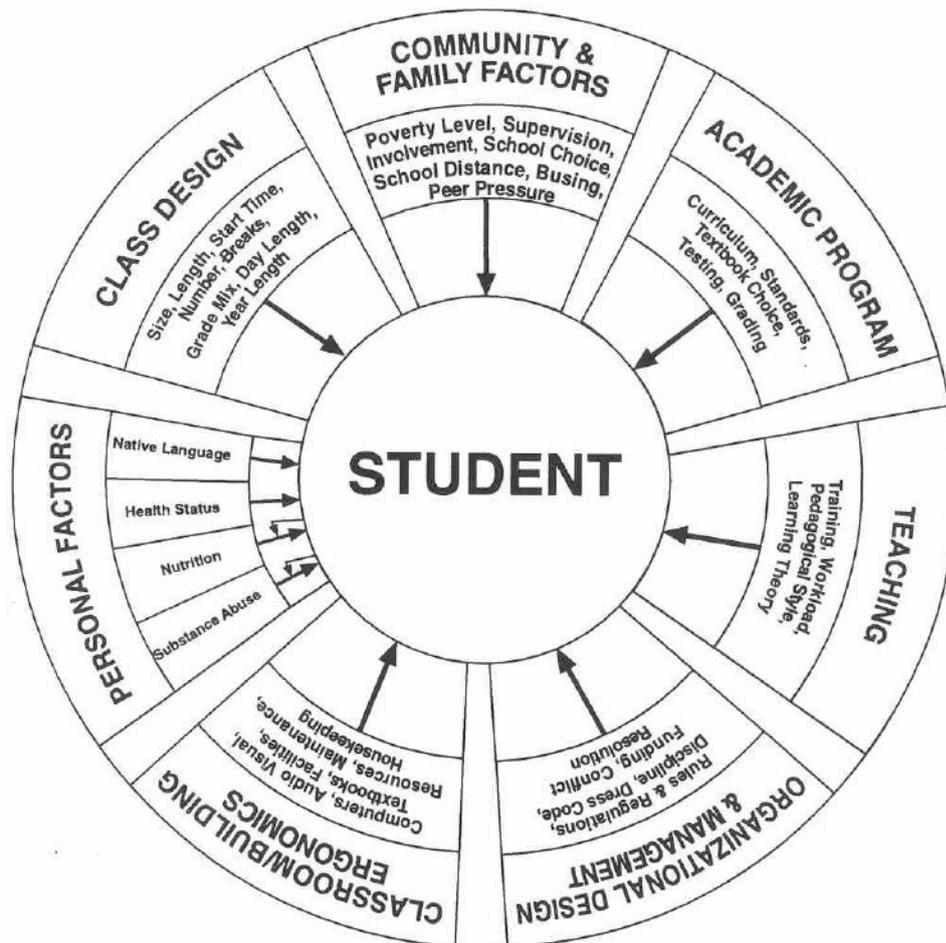
We know that place matters. Good learning spaces enable people to act in an effective and meaningful way. However, a lot of learning environments still resemble a sensory deprivation chamber and are more an obstacle than a tool of self-realisation. Space matters, and a fresh look at the physical spaces in higher education can help to seize students' full social, environmental, economic and cultural potential. A solution to the current situation could be an increase in student-centred learning environments, which would enhance the learning ergonomics in the specific buildings and spaces, which have historically been directed more for traditional teaching-centred learning (see Hoidn and Klemencic, 2020; Martel 2017; Cornell, 2002, etc.). The International Ergonomics Association, which defines different principles and perspectives, when it comes to human factors and ergonomics, defines ergonomics as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession applies theory, principles, data and methods to design, in order to optimise human well-being and overall system performance. The terms ergonomics and human factors are often used interchangeably or as a unit, a practice that is adopted by the IEA (IEA website).

Student-centred classrooms may, and do, include the use of technology, address the learning interests and needs of the students and acknowledge as well as focus on what students can also bring to the table. Learning, or educational, ergonomics is concerned with the interdependence of educational performance and educational design as well as the notion that the performance of students and educational systems is, to a substantial degree, context specific. We should assume that the scope of educational ergonomics encompasses all modes and levels of performance-design interaction that may occur in educational environments and systems (Smith, 2007; Smith, 2013).



The design of the educational process refers to, but is not limited to:

- Physical designs of instructional materials, environments and technologies (e.g. classroom implements and equipment, audio-visual materials and system, work stations, computer hardware and software, school classrooms and buildings,
- Designs of different skills, tasks, classes of knowledge and curricula targeted for learning,
- Social and interpersonal designs of the interactions of participants in the system with one another,
- Design, management and administration of jobs, supervisory relationships, organisation, policies and programmes of education systems and
- Design of communities, in which education occurs (Smith, 2007).



Source: Smith, T. J. (2007) The Ergonomics of learning: educational design and learning performance. *Ergonomics* 50 (10), pp. 1530-1546.

From a scientific perspective, the major challenge for learning ergonomics is to delineate which factors are the most critical contributors to variability in educational performance at the individual and system level (Smith, 2007). Once decisions are made and introduced into the physical space, they will affect at least a generation of teachers and students (see Schneider, 2002). Following are some specific examples of areas in ergonomics:

- Flat classrooms without a front of room (normally reserved for the instructor) suggest to students that they are expected to communicate and move through the space. In addition, equipping spaces with movable chairs, writable walls, larger tables etc. This nudges both students and instructors towards movement, free use of space and has the potential to create a more collaborative environment (Finkelstein and Winter, 2020).
- Research in the use of light in schools has shown that cool-white fluorescent bulbs (can) cause bodily stress, anxiety, hyper-productivity, attention problems and other distress leading to poor performance. Scientists have coined the term

malillumination, which describes sunlight deficiency and the negative, harmful effects of artificial pink or cool-white fluorescent lighting on behaviour, learning, health, hardiness and longevity (see John Ott on the science of light) (Martel, 2007). In addition, there has been renewed interest in increasing natural light in school buildings, which was the predominant means of illumination until the 1950s (Schneider, 2002).

- Fundamental to the teaching and learning process are also acoustics, both within a space and building. Excessive noise causes stress in students and a high presence of outside noise increases student dissatisfaction with their classrooms. Teachers and instructors also attach meaning to noise levels (Earthman and Lemasters, 1998; Schneider, 2002).
- When it comes to furniture, learning ergonomics focuses on functionality, comfort, safety and health, usability, and psychological appeal. The user should feel motivated to use the design over and over again. For example, when it comes to functionality, methods such as fold-n-go (desks, chairs), plug-n-play (audio-visual materials), say-n-see, relate-n-reflect, etc. (Cornell, 2002).
- Building age, quality and aesthetics also matter to the quality of teaching since it can add to a predominant good (or poor) physical environment.
- The question of school and class size has been long discussed between educators and pedagogues. The question relies on the matter of financing of education, since smaller schools and classes would require more instructors and therefore more capital investment.

The previously mentioned case of McGill University, and their restructuring of the physical teaching space, is an example of how spaces can be organised differently to serve both students and teachers/instructors. In practice, this included using larger (round) tables, modern audio-visual systems, moveable chairs, eliminating a clear front of room, etc., throughout their different faculties (Finkelstein and Winter, 2020).

Partners from Vytautas Magnus University have pointed to their Multimedia laboratory, where students can analyse, reveal and implement the latest multimedia technologies in practice, prepare bachelor's or master's theses, and perform creative tasks in a specialized multimedia laboratory. The laboratory is open to students and pupils of both Informatics and other VMU faculties. Problem-based teaching sessions are given and students can use the available laboratory equipment such as: installation equipment, 3D scanning, 3D models, motion and gesture recognition devices, 3D printing, professional photography and studio photo equipment, professional audio creation and other tools.

## Policy (normative/legislative) environment for the introduction of SCL and learning ergonomics

Recent studies and research in the European HE environment have found that the central role of knowledge creation in post-industrial economies and societies has given universities a pivotal role in society. Therefore the key functions of the university: conducting research and educating future academics and professionals are increasingly enacted in processes of knowledge creation (Reichert, 2019).

There has been a change in the demographic of the student population through the widening of accessibility of higher education to those who were previously excluded or not given equal opportunities. This poses both opportunities and issues, involving both a pedagogical challenge and also a shift in the teaching methods, which need to correspond to the heterogeneity in the student body (European University Association, 2017).

The European University Association has conducted several reviews on the institutional perspectives on the developments in the European Higher Education Area. It has to be mentioned that implementation of learning outcomes and student-centred learning are central reform goals of the Bologna Process and the EU Modernisation Agenda. This has contributed to the enhancement of learning and teaching, which in turn has impacted institutional strategies and structures that support learning and teaching (Gaebel et al., 2018).

There are differences in European areas as to with what speed active learning pedagogies are taken up and made mainstream. SCL first appeared in the European Higher Education Area in relation to the London Communique (2007). It was presented in connection with learning outcomes and pointed to purposes other than comparable degrees. Even though SCL and learning outcomes were not an invention of the Bologna process, they became a part of the pan-European governmental reform and therefore HEI had to start working with them. Student-centred, practice-based and flexible teaching approaches have also been mentioned in the EU's publication entitled 'The Changing Pedagogical Landscape', which emphasised that one of the findings of the study were innovations in the use of technology and in pedagogy. The examples they provided included adaptive learning, e-portfolios, flipped learning, inquiry based learning, learning analytics, MOOCs (Massive Open Online Courses) and open educational resources, and students as co-creators (Gaebel et al., 2018; European Commission, 2015).

SCL was fully taken into the process during the Leuven/Louvain-la-Neuve ministerial conference in 2009, where European Ministers responsible for Higher Education noted that "*student-centred learning and mobility will help students develop the competences they need in a changing labour market and will empower them to become active and responsible citizens*" (EHEA, 2009). Furthermore in the Bucharest Communique in 2012, Ministers confirmed their commitment and emphasised that higher education institutions should remain focused on "fostering student-centred learning, innovative

teaching methods and a supportive and inspiring working and learning environment” (EHEA, 2012).

SCL is also mentioned in the Bologna Process Implementation Reports. For example in the Implementation Report in 2015 (pp. 46-66), the paradigm shift to SCL is mentioned as “the precondition for the proper introduction of learning outcomes and assessment processes” (Gaebel et al., 2018; Eurodyce, 2015).

For SCL to be successfully converted into policy within either a single higher education institution or a system/network of institutions, the policy cycle must form a closed loop with continuous feedback. There is a debate with regards to whether change should come top-down or bottom-up. Both present individual benefits and downsides. EHEA (2010) suggest six steps to be taken:

- Analysis of problem,
- Identify or different actors,
- Identify drivers for change,
- Identify strategies to overcome barriers to change,
- Implement the change and
- Evaluate the impact of the change.

Other actors in European higher education, such as the European Association of Institutions in Higher Education, European Association for Quality Assurance in Higher Education, European Quality Assurance Forum and Education International, have all placed importance on student-centred learning and learning outcomes. The learning society in a globalised world requires a number of competencies that are universally accepted, for example, intercultural competencies, multilingualism, international awareness, ICT-skills and the ability to learn how to learn in different settings (ESU, 2015).

An analysis published by the European Commission in 2020, states that the paradigm of teacher-centred learning is currently giving way to SCL. One of the main conclusions of the study was that “the EU and its higher education sector would benefit from reaching an agreement among EU and national policy makers, stakeholders and higher education institutions on the core elements which constitute SCL” (Klemencic, Pupinis and Kirdulyte, 2020: 6). The analysis also acknowledges that some elements of SCL are more widespread than others and, for the most part, we are still experiencing a teacher-centred paradigm.

### Training materials (examples) for SCL on students/teaching level

Sparrow, Sparrow and Swan (2000) discuss some examples of teaching and learning activities (which were tried in primary mathematics education units):

- **Self-paced teaching booklets:** designed to support workshop sessions, distance education and personal study with a non-negotiable core of tasks and knowledge and optional tasks, which could provide additional work in areas of weakness.

- **Independent study modules and self-directed learning kits:** students are given some choice (two out of four themes) in a subject matter and encouraged to work in teams, select their place and time of working as well as have the ability to consult the lecturer if needed.
- **Poster presentations:** giving the students the freedom to present the information in a given style, while providing a baseline structure
- **School-based, action research projects (project partnerships):** students form a small group centring on a common interest and take responsibility for completing the project in a given time frame.
- **Self-initiated assignments:** undertaking an assignment within a minimal structure, thus giving students the freedom to pursue an area of the course, which was of most interest to them.

In a study conducted by the European Students' Union and Education International, the authors found that seminars and projects are also a part of respondents' learning experience, respectively 69% and 51%. Other teaching methods mentioned were tutorials, fieldwork, workshops, debates and project work (ESU, 2015).

Following are some examples of methods and practices, which put students in the centre of teaching and learning exercises:

1. Being clear about how teachers will promote, measure and celebrate understanding
2. Modelling 'how to think' for students
3. Helping students understand what's worth understanding
4. Diversifying what you accept as evidence of understanding
5. Creating curriculum and instruction around a need to know
6. Collaborating with students to create the rubric or scoring guide
7. Letting students choose the project's purpose
8. Choosing 'power standards' from your curriculum after meeting with both students, (parents), and community members that voice their unique societal and cultural needs,
9. Letting students choose their own media form that reflects the purpose of the reading
10. Choice boards
11. Placing struggling readers in a literature circle that gives them an authentic role that they can be successful in, allows them to hear oral fluency and reading speed model and keeps them from feeling 'broken'
12. Starting class with a story
13. Using the on-demand writing prompt as the summative assessment
14. Framing learning in terms of process and growth and purpose
15. Choosing what's graded carefully, considering other work as practice (Heick, 2020).

Existing good practices – Five principles for strategic interior design

Classrooms and lecture halls at universities are often large and can make students feel disconnected from their peers and teachers. To solve this problem, architects often design multipurpose classrooms with flexible furniture that students are welcome to use for their own projects outside of classes. Creating fewer large lecture halls and more intimate learning spaces, both formal and informal, that encourage engaged learning is a better approach than the traditional passive listening.<sup>1</sup>

Strategic interior design can be engaging and motivational, enabling all students to achieve their potential. When exploring design principles, we have found a multitude of approaches. We have selected and combined **five design principles** that are common to various successful design studios and universities across the world. We can call them 'universal', as the common aim is to maximize usability by individuals with different backgrounds and needs. The selected principles are the following:

1. **Make learning spaces flexible and modular.** The aim of this principle is to ensure that a wide diversity of participants' experiences are enhanced and that the space is used for different purposes. Flexibility and modularity here means that the design accommodates a range of individual preferences and abilities and that the space in general can be easily transformed depending on the needs of the students and the type of activities held in the space. This can be achieved by:
  - using high working surfaces, so that students can work standing, providing more freedom to move and by applying furniture that allows students to vary their body posture (sitting, standing, walking).
  - applying furniture that allows varying between learning activities with a focus on interactions with the teacher, fellow students, the content and the surrounding environment of the classroom.
  - ensure that the design is equitable and useful to people with diverse abilities, for example by using furniture that may be raised or lowered to accommodate users of varying height, or individuals who use wheelchairs.
  
2. **Encourage collaboration among students.** The aim of this principle is to foster interaction through active and collaborative spaces for learning. Learning spaces should provide features that permit students to work both individually and in collaboration with one another. They should facilitate communication and interaction between students and faculty. This can be done by:
  - equipping the space with large working surfaces, such as round tables, white boards, white board foils, touch screens, flipovers or writable tables to enable collaborative thinking.
  - arranging tables in geometrical ways so that interactions can happen naturally.

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<sup>1</sup> <https://hmcarchitects.com/>

- 3. Introduce tech-friendly solutions.** The aim of this principle is to foster innovation through classroom design and technology and to provide a rich and inspiring student experience. Learning spaces should allow students to actively engage with content and include a range of technologies that support multiple modes of teaching and learning. This can be done by:
  - creating multimedia (smart) classrooms that are equipped with the latest audiovisual technology, available for use also outside of the students' official classes. The room's configuration should be set for different uses.
  - tables can be equipped with large monitors, camera, microphone, computers; video wall; touch control system that facilitates collaborative work, videoconferencing; library of ready-to-use, adaptive, educational-oriented graphical components designed to optimally interact with the various educational applications of the ambient classroom on different devices.
- 4. Improve student comfort and focus.** The aim of this principle is to recognize classroom functionality for space efficiency and optimization. By increasing the informality of the space the students feel safe and comfortable. This can be achieved by:
  - applying "homey" decorations and using colours; introducing "soft" surfaces, such as couches and pillows, low furniture, such as coffee tables and tuffets.
  - allowing students to alter the learning space and providing different types of furniture so that students can choose where to work.
  - use of the design should be easy to understand and intuitive, regardless of the user's experience, knowledge, language skills, or current concentration level.
- 5. Connect learning spaces to public spaces.** The aim of this principle is to integrate learning spaces within a larger campus context to ensure an ease of transition between spaces and to better support high-impact practices inside and outside the classroom. This can be done by:
  - creating hallways that connect the SCLEs with other, more "traditional" classrooms as well as libraries, lecture halls, gardens etc.
  - making it accessible to both students and the staff. Facilitate access also to students from other faculties.

### Examples of student-centered HE spaces

- **University College of Northern Jutland, Hjørring, Denmark**

UCN is a university of applied sciences. It provides higher education and performs research, development and innovation activities within the four main areas of

business, social education, health and technology<sup>2</sup>. UCN was formed as a result of the Danish Act on university colleges of higher education, which was adopted by the Danish parliament in 2007. It was the first college to merge with a business academy. UCN wishes to be leading in future-oriented education. Their goal is to allow graduates to be ready to participate in and develop the labour market and society of the future. This requires a very particular approach to education. “Reflective Practice-based Learning (RPL) forms the base of UCN's study programmes as a shared understanding of learning and teaching. We believe that reflection bridges the gap between theory and practice. That’s why we at UCN continuously work to develop a pedagogical approach to teaching and learning that promotes reflection – thereby creating a high learning outcome.”<sup>3</sup>

UCN is designed by Rosan Bosch<sup>4</sup>. Her studio creates unique spaces that let individuals unfold their curiosity, creativity and imagination. Rosan Bosch studio has developed a distinctive design that highlights and facilitates communication, interdisciplinary meetings, and knowledge sharing. Cave-like lounge areas, interactive platforms, and multifunctional common areas support group work and allow flexible forms of collaboration for the students. Tall red trees rise among the tables in the common area and provide a unique spatial experience and signature for the college – as reminders of nature's growth. With graphic elements in the wallpaper and collages, the institution's many spatial modules link together and create identity markers for the different fields of studies. University College of Northern Jutland has gained a distinctive profile with its new interior, which makes the institution's activities visible both internally and externally. Spatial design supports the pedagogical principles and acts as an active tool for learning in an inspiring environment.

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<sup>2</sup> <https://www.ucn.dk/english/about-ucn>

<sup>3</sup> UCN white paper on RPL, <https://blad.ucn.dk/white-paper-on-rpl/>

<sup>4</sup> <https://rosanbosch.com/en>



*Figure 1. UCN interior. Image credit: Rosan Bosch.*



*Figure 2. The Planet - a floating digital sculpture that acts as a dissemination platform for film, info, and posters. Image credit: Rosan Bosch.*

- **ISM university of Management and Economics, Vilnius, Lithuania**

The ISM university<sup>5</sup> was established in 2001. It is a management oriented university with quite a traditional setting, but it also has two spaces that enable students centered learning and experimentation. The Innovation Base of ISM University is an experimental space for specialists in various fields or their teams who want to create new business ideas - innovative projects, products or services. Anyone with innovative ideas can come to share, implement and discover like-minded people. The Art Studio, which is an integral part of ISM university, was established in 2004 and aimed at developing connections between sciences and art, stimulating imagination, fostering individual and group creativity. During the years of its existence, more than 1000 works of art have been created.

The idea of a modern business laboratory, which has been developed for many years, is today turned into an integral space of ISM University, where a multidimensional platform of entrepreneurship, innovation and creativity is developed on a daily basis. The ISM Innovation Base, designed by architects Aušra Gvildienė and Alius Gvilda, is designed for various activities, therefore it is adaptable to its user who can work in a team or individually. This place is for people who are building a community and their own culture, so the Innovation Base is both connecting and allowing them to work independently. The main mission of the ISM Innovation Base is to foster innovative business initiatives, open up research opportunities, promote innovation in various fields of management, governance and public organization, and bring together the ISM Innovation Base community to share experiences and knowledge with investors and business.

While universities in Lithuania create new spaces or rethink the existing ones, the Innobase and art studio is quite unique since it is well thought-through. Also it is seemingly a big part of the university – Innobase is a separate building that is dedicated for those interactive experiential education activities related to artistic creation, which is not common in business schools.

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<sup>5</sup> <https://www.ism.lt/en/homepage/>



Figure 3. Interior of the Innovation BASE

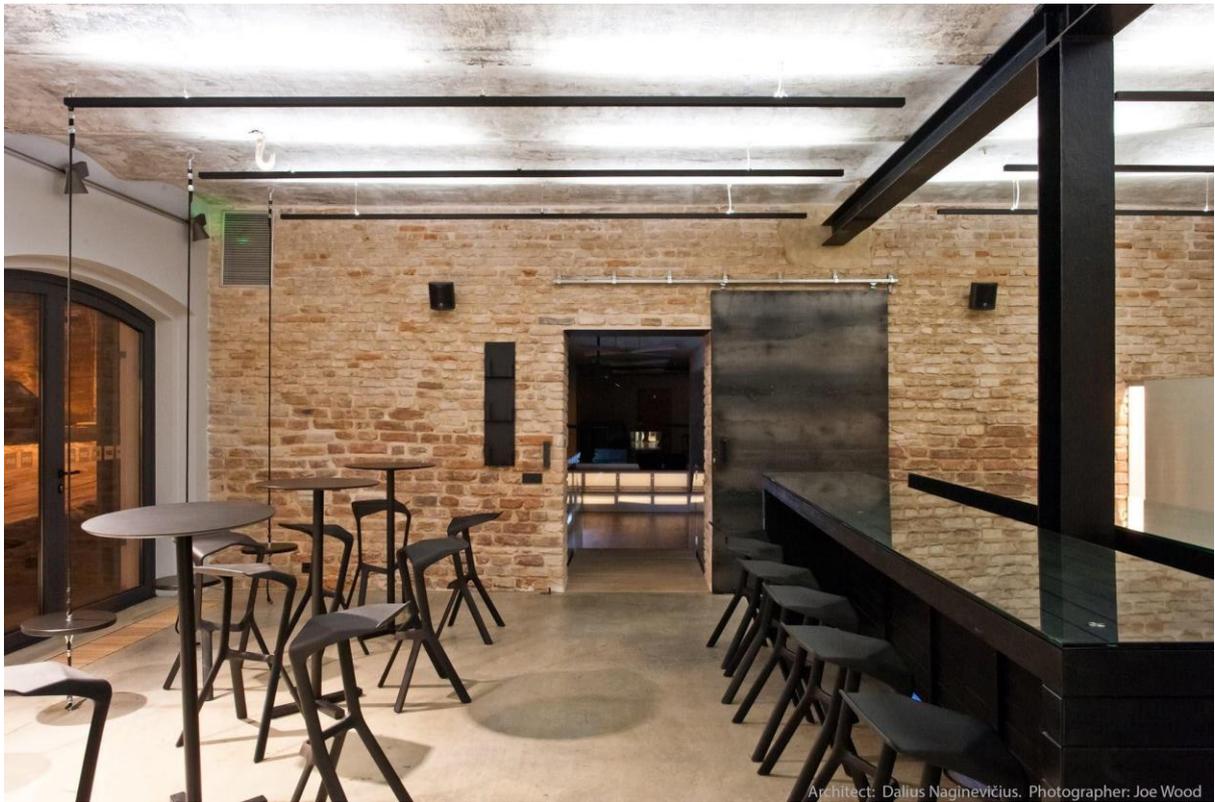


Figure 4. Interior of the Innovation BASE. Image credit: Joe Wood

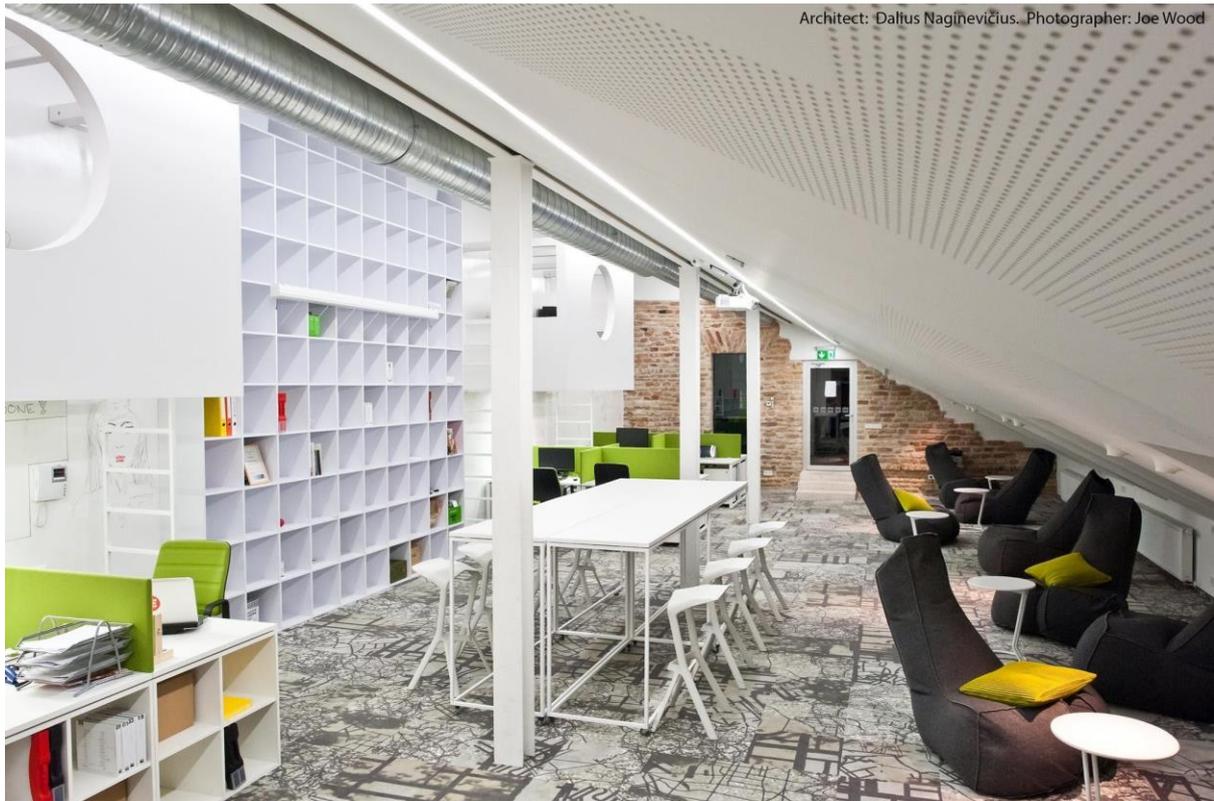


Figure 5. Interior of the Innovation BASE. Image credit: Joe Wood.



Figure 6. Interior of the Innovation BASE

- Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), University of Split, Croatia

In the context of Croatia, alternative spaces are not common. The standard design of spaces that differs from the traditional classrooms are usually multimedia classrooms or reading rooms that students can use for work or simply “hanging out”. Not many Universities have other types of spaces that go out from these usual setups. However, we have selected one at the University of Split, that has been developed with the student-centered approach. The University of Split was officially established on 15 June 1974. It has expanded during the course of the past 45 years to include eleven Faculties, one Academy of Arts and four University Departments. There are about 20,000 students enrolled in the University’s undergraduate, graduate and post-graduate programs. FESB faculty is based on separate units involved in teaching and scientific research, administrative and technical activities. Departments, as academic organisational units, manage, organise and implement teaching and research activities and professional services.

PICS space at the FESB faculty is a pre-incubator and coworking space launched as part of the ICT County project<sup>6</sup>. It hosts numerous lectures, workshops, meetups, and is used daily for work and study. ICT County has created this space to help advance the technology sector in Split-Dalmatia County. It is located on the third floor of FESB and can be entered from outside of the building itself or through the faculty. In PICS students have at their disposal 22 computers for work and study, large hall for lecture and events, a 3D printer that members can also use and a large presentation hall equipped with a projector, speakers and cameras as well as smaller workspaces. Members also have access to a lounge area equipped with the Playstation 4 for relaxing after work; mini library with books focused on entrepreneurship topics; small makerspace with Arduino and Raspberry PI computers. As part of PICS, everyone can develop their own projects. For this purpose, the members of the ICT County team are available throughout the year to help students and connect them with individuals who can further provide support.

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<sup>6</sup> <https://www.ictzupanija.hr/o-nama>



Figure 7. PICS space at FESB from outside. Image credit: FESB.



Figure 8. Inside of the PICS space at FESB. Image credit: FESB.

- **Alpen-Adria University Klagenfurt, Austria**

University of Klagenfurt is a higher education institution located in the Austrian state of Carinthia and is the largest academic institution in the region. In 2016, 10,319

students were enrolled at the AAU within 50 study programmes. The University was originally founded in 1970 and relaunched in 1993. It is situated 30 km from the Slovenian and 60 km from the Italian border. It supports bi- and multilingualism, especially in the context of the Slovenian minority in Carinthia.

For the purpose of the review of good practices, the focus with regards to the University of Klagenfurt rests on the University's central and north wing (13,000 m<sup>2</sup>), which were fully refurbished with a budget of €26 million. The spaces, originally constructed between 1974 and 1977, were modernised and in some cases, the layout of rooms was adapted. The University website describes the refurbishment of the campus as "freeing from its former 70s vibe".<sup>7</sup> Work on the refurbishment started in 2016 and finished in the spring of 2019. The project was carried out in phases, which allowed for the continued normal operations of the institution. The refurbishment provides long-term functional, economic, ecological and aesthetic improvements for the university itself, for employees and for students.

New spaces are open, with moveable furniture and wall partitions, which can be closed or open, depending on the use of the space. While the lecture hall remains oriented towards more traditional teacher-centred learning, four lecture halls were renewed in the central tract. Acoustics, ventilation, accessibility and seating were renewed and all areas now have a contemporary design. The Oman Hall was opened up to the aula, but thanks to mobile partitions it can be completely closed, if required. In the north tract, a new lift was installed to improve accessibility. There were also some additional measures such as the refurbishment of the connecting passage between the north tract and Vorstufe building, the implementation of anti-glare measures in the offices, refurbishment of the external staircases, repair of the facades on the south, central and north tracts, renewal of emergency lighting and the provision of additional bicycle parking spaces. As mentioned in the literature review of student-centred learning, open spaces with natural light have been proven to encourage quality learning.

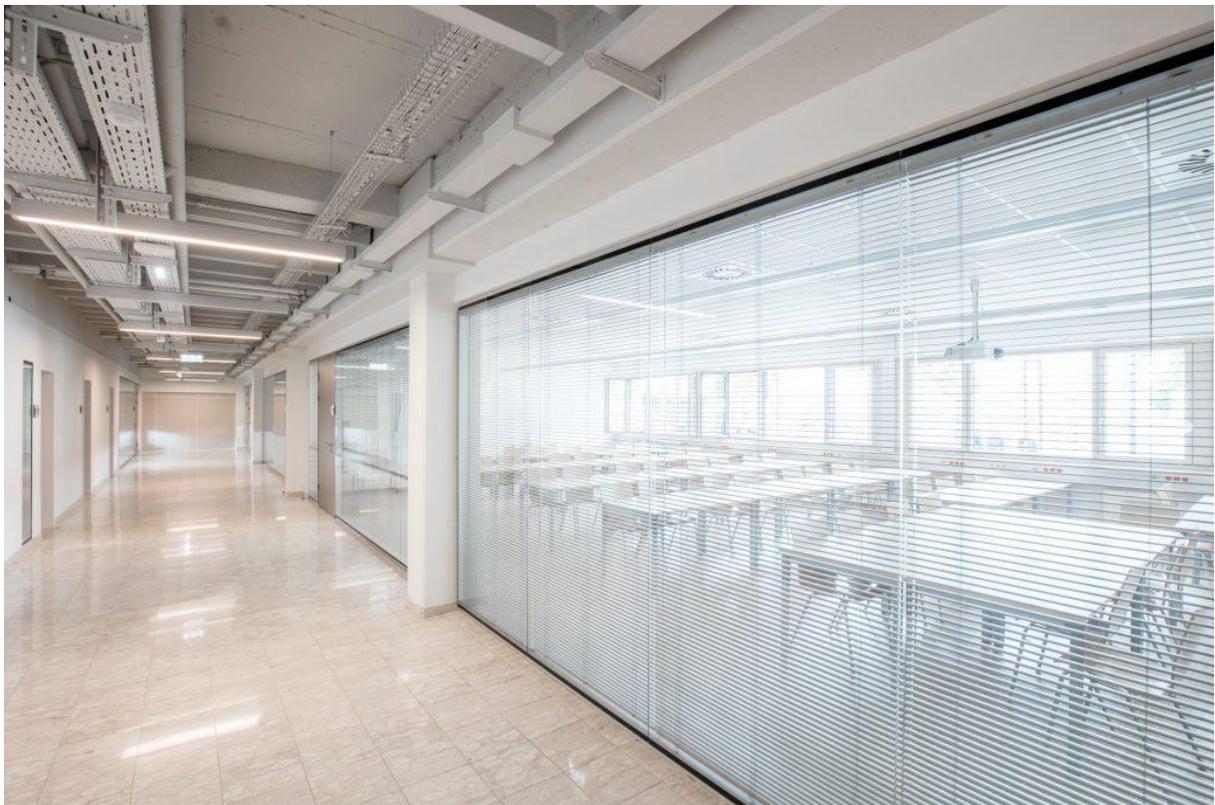
The University of Klagenfurt is a good example of effective and user-driven remodelling of learning spaces. The refurbishment was shortlisted for the Prix Versailles – Campuses 2019 (under UNESCO patronage), together with buildings of the University of Chicago in Hongkong, Barnard College, Stanford University, SPA Vijayawada and Skolkovo Institute of Science and Technology, which won the competition.

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<sup>7</sup> <https://www.aau.at/en/university/campus/refurbishment/>



*Figure 9. Aula space. Image credit: aau/Daniel Waschnig*



*Figure 10. Refurbished seminar rooms. Image credit: aau/Daniel Waschnig*

- **IE University, Segovia, Spain - IE Creativity Center**

Associated partner of CREST project, IE University<sup>8</sup> in Spain and its Creativity Center, applies a hybrid model to facilitate community engagement. This involves physical spaces, digital spaces, non-academic spaces and mental spaces. "IE Creativity Center is an open space that triggers creativity transversally, facilitating interaction between Segovia and the diverse IE universe."<sup>9</sup> The Center is strategically placed within Casa de la Moneda from the XVI century and it is a ten minute walk from IE University campus. IE University has signed a collaboration agreement with the Segovian city council to transform part of La Casa de la Moneda into a business space run by the university to promote innovation and entrepreneurship in Segovia. The Center is open to anyone looking for a place to work on their projects, engage in recreational activities and meet with friends. The Creativity Center is a dynamic, innovative, tech-forward space for creators and entrepreneurs. It has several common areas such as the exhibition hall, ballroom, conference room, painting room, recording studio and workroom. It also offers free yoga classes during weekdays and hosts a radio show several days a week. The workspace is perfect for working independently, or collaborating on group projects. The main purpose of the Creativity Center is to serve as an incubator for IE University student projects and get support from Segovia's business community.<sup>10</sup>

Since the beginning of the pandemic, many things have changed in terms of spaces for sharing, enjoying and learning. The turning point is to understand how by resilience and adaptation we can put an end to the set of expectations and/or limitations we lately lived with. We are no longer bound to long-term plans or specific rooms/venues, the anytime-anywhere fashion is here to stay. In this section we observe how the IE Creativity Center adapted to new challenges caused by the pandemic and how the online space became increasingly more important. IE University, and the IE Creativity Center have moved beyond the premises of the AHEH European hub<sup>11</sup> and occupied others both online and offline. IE Creativity Center cares as much about the academic domain as about facilitating the power of the non-academic in order to form individuals outside of the classrooms.

A hybrid model is about sharing their recent experience not only in building new spaces, but also adapting existing ones to an endlessly changing environment. The adaptation of existing spaces was rather challenging, however, they managed to continue the activities in the adapted spaces (large areas, ventilation, and investment in equipment to measure temperature and continued cleaning of used areas...). Looking at other spaces beyond their own premises allowed them to: increase audiences, multiply the scope of their actions, build collaborations with third parties,

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<sup>8</sup> <https://www.ie.edu/university/>

<sup>9</sup> <https://www.ie.edu/university/campus-life/ie-creativity-center/>

<sup>10</sup> Ibid.

<sup>11</sup> <https://www.artshumanitieshub.eu/hubs/ie-creativity-center/>

continue offering their programme and expand the feeling of belonging of their students and staff. Despite being a private international university, they have put tremendous efforts in working closely with the local community. They offer their premises to this community enabling interaction with students.

Using online tools and technologies made a bridge between the two campuses in Madrid and Segovia which contributed to the unification of their worldwide diverse community. This approach of looking outside of the academic environment allowed the staff to evolve from educators to community facilitators. The hybrid model allows them not to be restricted to any limitations such as timetables, spatial capacities, budgets etc. In the last couple of years, they focused on creating different formats to exhibit students' creations. They have expanded their audience, reinforced and readapted the use of spaces, and created innovative (online) ones, for sharing the artistic and educational content.



Figure 11. Interior of the IE Creativity Center. Image credit: Teresa Olombrada



Figure 12. Interior of the IE Creativity Center. Image credit: IE Creativity Center.



Figure 13. Painting room. Image credit: IE Creativity Center.

## What can we learn from creative hubs?

New communities around the world are convened in creative spaces called hubs, which allow unlikely allies to connect and find support. The hubs may take many forms, from makerspaces to labs to clusters, but they all share a commitment to contributing to a better future, inspired by new forms of leadership. Hubs are not simply spaces, their communities are at the forefront. Some specialise in a specific sector while others welcome a wide range of disciplines together.<sup>12</sup> Creative hubs are taken as examples from which HE institutions can learn a lot from, not only in the sense of the design of the physical space itself but also in the “mindset” and the values based on collaboration, skills development and fostering interdisciplinary interactions that contribute to growth. Creative hubs develop and retain talent, create engagement and educational opportunities. They pay particular attention to ways their spaces are designed.

Creative hubs’ spaces are based on the needs of their users who often have different backgrounds and experiences. Hub leaders are looking at the emerging trends shaping today and tomorrow’s workspaces taking in consideration the skills needed for the future of work. In the context of HE design, the themes that inform 21st-century are the same: collaboration, technology, engagement and sustainability. Effective designs in educational institutions are based on a clear sense of learners’ needs and educational goals and on the sense of what the educational goals are that inform effective designs. In that endeavour, it is important to know how we can plan and prototype solutions so they can evolve as needs and goals change over time.

We believe that collaboration and creativity should be in the center of the HE institutions of the future. “Collaborative learning is essential today as it helps students to develop higher-level thinking skills, self-esteem and empathy. Therefore, collaboration is being promoted in schools and workplaces all over the world, although often without a deep understanding of how collaborative processes work best.”<sup>13</sup> Creative hubs are actually those who know how collaboration works best. Collaborative environment in creative hubs is made in a way that the arrangement of the open space facilitates interactions with the community members. These interactions often result in new interdisciplinary projects and partnerships. Fostering an informal environment becomes conducive to the sharing of ideas in a way that builds trust and strengthens the community. The users of creative hubs are often freelancers and micro SMEs, who would normally work from home. In that environment they are able to connect, collaborate and share with other like-minded people. Being part of a community increases freelancers' confidence, experimentation,

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<sup>12</sup> <https://creativeeconomy.britishcouncil.org/themes/hubs/>

<sup>13</sup> Daniel Wilson, 2020. <https://rosanbosch.com/en/journal/learning-inspired-daniel-wilson-collaborative-learning>

collaboration and growth. Together they can pitch for work, access resources and tools, inspire one another and attract investment as a collective of disciplines.<sup>14</sup> Same can apply to students in HE.

### **Example of spatial organization of a creative hub:**

- **Coworking space / meeting rooms and offices:** a combination of workplace and supporting facilities such as meeting rooms, event spaces and offices. These kinds of open spaces with desks arranged in a flexible way contribute to informal networking, transactional relationships, knowledge exchange and business support. By using an open space for work a sense of community and belonging is created.
- **Studio space / Labs:** spaces for creative work, experimentation, learning, training, knowledge exchange between the community members. Example is a maker lab - prototyping, design and fabrication space, consisting of different tools available for use, co-creation and learning by doing.
- **Gallery spaces:** used for occasional exhibitions and often offered to members of the creative community and users of the hub to exhibit their works and organize their own events. These facilities attract people from outside which is also important as a connection between the hub members and the “general” audience.
- **Informal spaces / living rooms / cafés:** these are spaces for informal socializing. They are usually physically connected with other spaces. They are important because many connections and collaborations also happen there. Often these can be freely used by external visitors as this generates new audiences and potential new members.
- **Versatile furniture:** flexible, modular and freely moveable furniture open to variation allows creative hub users to adapt the space to their needs and working styles and change the space dynamically from more open, public setting to a more private way of working. This fosters interaction and makes the space welcoming for different working styles.

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<sup>14</sup> <https://creativeeconomy.britishcouncil.org/projects/hubs/>

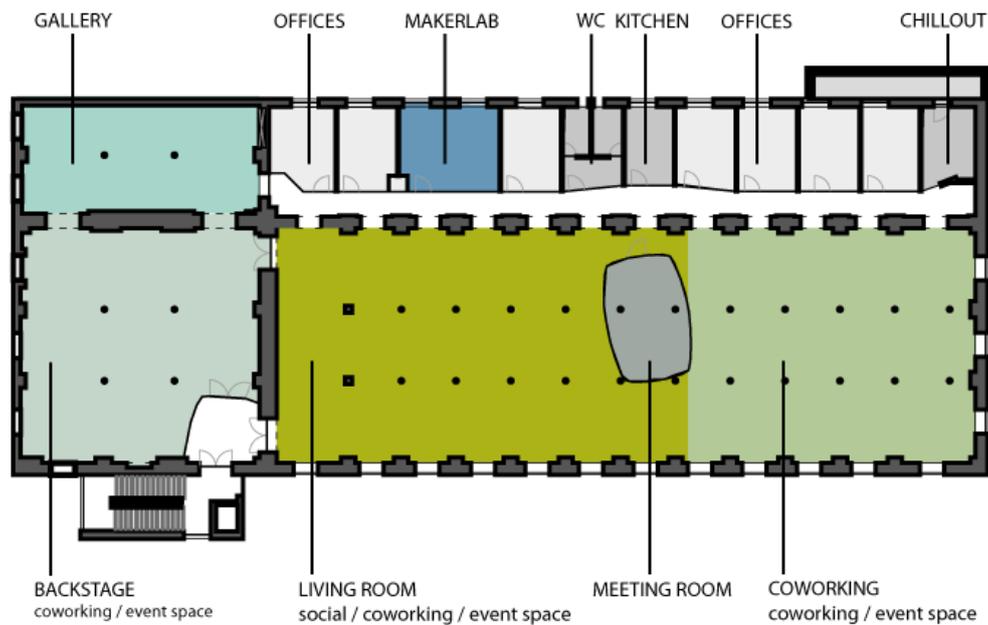


Figure 14. Former space of the creative hub “Poligon”, Ljubljana, Slovenia.  
Image credit: Poligon.

#### Creative hubs in Higher Education Institutions

- **Liverpool John Moores University, UK - FACTlab**

Liverpool John Moores University (LJMU) has over 180 years’ experience educating students in a wide range of disciplines, spanning the arts, humanities, education, health, science and technology and we offer a diverse range of undergraduate degrees, postgraduate taught programmes and research opportunities. Experimental Technologies Lab (ETL) is a result of four years of research pursued at a pioneering workshop and research space, FACTLab. It is a collaboration with Liverpool’s FACT (the Foundation for Art and Creative Technologies), the UK’s leading new technologies arts organisation. In ETL, researchers, artists and technologists work together to produce innovative projects.

Co-design is at its core. People are invited to explore the possibilities of creative technology through hands-on experimentation. It is an interdisciplinary incubator aimed at practice-based research, developing critical thinking; projects and cultural activities; sharing of knowledge and resources in collaboration with artists, designers, scientists, technologists, HEIs and the commercial sector. Their facilities include traditional workshops, TV and sound studios, the X-Gallery digital and creative gallery for experimental media, an immersive projection room VR and numerous 3D technology together with devices for interface development. Other activities that take

place in the FACTlab are summer schools, workshops and other types of gatherings that support networking and knowledge sharing.<sup>15</sup>

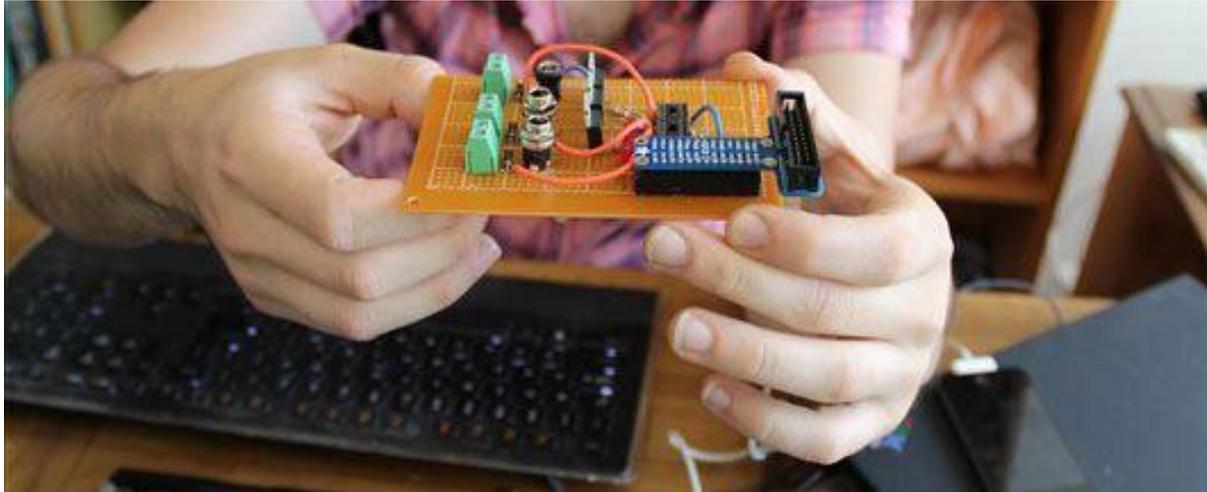


Figure 27. FACTlab. Image credit: FACTlab.

- **Delft University of Technology - The Why Factory, the Netherlands**

TU Delft is the oldest and largest technical university in the Netherlands. Their 8 faculties offer 16 bachelor's and more than 30 master's programmes. They count more than 25,000 students and 6,000 employees who share a fascination for science, design and technology. The common mission of TU Delft is to achieve impact for a better society.<sup>16</sup> The Why Factory at the University is a global think-tank and research institute, run by MVRDV and TU Delft. It explores possibilities for the development of cities by focusing on the production of models and visualizations for cities of the future. Education and research at The Why Factory are combined in a research lab and platform that aims to analyze, theorize and construct future cities. "The Why Factory thus acts as a future world scenario making machinery. Moreover, we want to engage in a public debate on architecture and urbanism. The Why Factory's findings are therefore communicated to a broad public in a variety of ways, including exhibitions, publications, workshops, and panel discussions."<sup>17</sup>

After a fire destroyed their premises, The Why Factory and the faculty of architecture of Delft University moved into the former main building of the university. Dutch

<sup>15</sup> <https://www.ljmu.ac.uk/about-us/news/articles/2015/6/9/unlocking-creativity-factlab>

<sup>16</sup> <https://www.tudelft.nl/en/about-tu-delft>

<sup>17</sup> <https://www.tudelft.nl/onderwijs/opleidingen/masters/aubs/msc-architecture-urbanism-and-building-sciences/master-tracks/architecture/programme/studios/the-why-factory/>

architects MVRDV<sup>18</sup> have designed the courtyard for the Why Factory research facility and flexible furniture was designed by Richard Hutten. The project was awarded the LAi prize in 2009. “MVRDV designed the three floor tall wooden structure, containing lecture halls, meeting rooms and the premises of the research institute. An auditorium stair climbs to the top, literally putting the students on top of their teachers.”<sup>19</sup> The flexible furniture allows the space around the tribune to switch function between research hall, lecture hall and exhibition space. This strong color was chosen to emphasize the independent status of The Why Factory within the TU Delft. The wooden construction of the Tribune which accommodates the office and meeting rooms within, is painted in the same color so that the institute is a unified element within the space. The ground floor of the tribune provides a conference room and lecture room. On the first floor are the offices of various collaborators, and on the top floor is another meeting room. The tribune can also be used as an informal work space. This is facilitated by a strong wifi-network and sockets at the seats. The pyramid form of the Tribune allows for additional work spaces on the balconies.

The goal of the furnishing was to be versatile and flexible, adaptable to a wide variety of uses: studying, working, meeting, model building and storage, film projections, exhibitions and of course parties and events. Eight tables for making models are distributed in the open space. Extra shelving underneath the tables allows for storing the models, and the tables are on wheels so they can easily be put aside to make room for a presentation or an event in front of the Tribune. The tables are also designed for exhibition displays.

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<sup>18</sup> <https://www.mvrdv.nl/>

<sup>19</sup> <https://archide.wordpress.com/2009/12/09/the-why-factory-by-mvrdv-and-richard-hutten-delft-netherland/>



Figure 30. The Why Factory interior. Image credit: MVRDV architects.

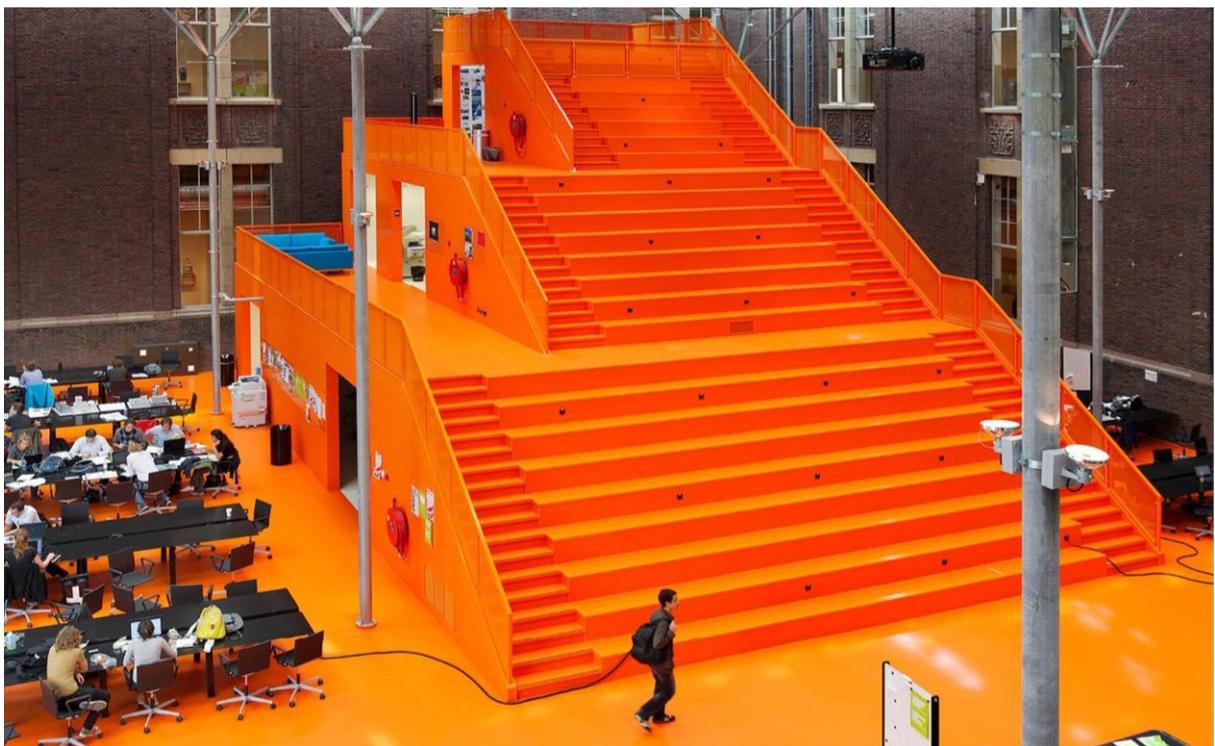


Figure 31. The Why Factory interior. Image credit: MVRDV architects.



*Figure 32. The Why Factory interior. Image credit: MVRDV architects.*

## CURRENT RESEARCH

### Analysis of the best digital tools

While addressing the issue of how to enhance SCL by digital tools, the future has much potential since today there is no actual tool suited for that. The most used tools by HEIs are Office 365 (including Microsoft Teams), Zoom, Moodle, BigBlueButton. There are quite many other tools that are used by different teachers or different universities to address their needs. Some tools are developed and used only within national borders of some countries. These tools are meant to help the educational process. Nonetheless, they do not necessarily have all features that would enable that educational process to become more SCL.

During a state of the art analysis, consortia analysed digital tools that are used mainly in the following three countries (Croatia, Lithuania and Slovenia). In addition, there was a survey that covered a much wider region (Denmark, Finland, Germany, Latvia, Poland, Sweden). The analysis has shown that the main digital tools surpass national borders and are used across the HEI's sector.

### **The main tools**

#### **Moodle**

Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments. The software can be downloaded to a web server or this can be done by a Moodle Partner. It is built by the Moodle project and coordinated by Moodle HQ, which is financially supported by a network of over 80 Moodle Partner service companies worldwide. As of 15<sup>th</sup> June 2020, Moodle had more than 213 million users across both academic and enterprise level usage. With over 10 years of development guided by social constructionist pedagogy, Moodle delivers a powerful set of learner-centric tools and collaborative learning environments that empower both teaching and learning. It is provided freely as Open Source software, under the GNU General Public License. Anyone can adapt, extend or modify Moodle for both commercial or non-commercial projects without any licensing fees and benefit from the cost-efficiencies, flexibility and other advantages of using Moodle. There is a range of built-in features, including external collaborative tools such as forums, wikis, chats and blogs. Moodle can be adapted with Plugins, of which there are around 1790 available currently.

The basic structure is organised around courses. These are basically pages or areas within Moodle, where teachers can present their learning resources and activities to students. They have different layouts but usually include a number of central sections, where materials are displayed and side blocks offering extra features or information. Courses can access content for a year's studies, a single session or any other variants

depending on the teacher or establishment. They can be used by one teacher or shared by a group of teachers. The front page usually includes information about the establishment itself and can be highly customised. How users join the site also depends on the establishment. Everyone who logs into Moodle has no special privileges until they are allocated roles by the administrator according to their needs in individual courses or contexts.

A teacher/instructor/professor in a Moodle course can select items from three different elements which together assist in the learning process.

- Activities: an activity in Moodle is a feature where students learn by interacting with each other or with their teacher. They might for instance contribute to a forum, upload an assignment, answer questions in a quiz or collaborate together in a wiki. Activities can be graded. Activities usually appear in the central area of the course. There is a list of standard activities and extra ones can be added by the administrator.
- Resources: are items that a teacher can add to a Moodle course to support learning, such as a file, a video or link to a website. A resource differs from an activity in that it is static; i. e., the student can merely look at or read it, rather than participate.
- Blocks: are items that the teacher can add to the left or right of a Moodle course page. They provide extra information or links to aid learning. Blocks are a bit like widgets elsewhere online and can contain for example, RSS news feeds, quiz results, a calendar, links to blogs, glossary terms or private files. There is also a simple HTML block which can be customised as the teacher wishes.

The H5P plugin for Moodle allows users to have access to lots of different interactive content types. Another great benefit with H5P is that it allows users to easily share and reuse content. To reuse content, users have to download the H5P they would like to edit and make changes. It is Open Source, Free to Use, HTML5 and responsive. There is a note that H5P should not be used for exams or similar, due to the fact that people with programming skills may cheat in H5P interactions and obtain the full score without knowing the correct answers. H5P can also be used on other websites and can be used to produce mobile friendly content. H5P empowers everyone to create rich and interactive web experiences more efficiently. All that is needed is a web browser and a web site with an H5P plugin (see [website](#) for further details).

Moodle being open-source allows to adapt the system on the national or organization level. Croatia has developed two versions **Srce** and **Merlin** that enable good organization of digitized educational materials, communication and cooperation with students, creating tests and questionnaires.

In 2007, University of Zagreb established the E-learning Centre at Srce with the aim of starting a systematic implementation of e-learning and enhancing the quality of university education. That included providing a virtual learning environment (VLE) for all the varied and diverse institutions of University of Zagreb, many of which did not

see how e-learning could fit in their strategy. Srce faced an additional challenge in that most faculties and teachers did not have the knowledge or capacity to create and maintain their own platforms.

**VLE Merlin is a** virtual learning environment (merlin.Srce.hr), based on Moodle Core and connected with Mahara (e-portfolio), Adobe Connect (webinars) and Information System of Higher Education Institutions (ISVU). Through Merlin, new opportunities<sup>20</sup> in education are available to students. In this way the student can participate more actively in the learning process and has greater availability of information about the e-course and teaching materials of the e-course itself. Communication between teachers and students can take place via email, forums, dialogue and chat. Students can also communicate with each other within the system and exchange information more easily. The student can thus better master the teaching material and prepare for the exam. Teaching materials are available at any time from any location as well as the results of exams, seminars and colloquia. An overview of all grades and tests set by the teacher can be accessed. By using the Merlin system, students have more control over the process of their education.

Every user of the Merlin system has a role to play. There are administrators who open new courses and administer data on teachers and students. There are also course supervisors who are allowed to view all or only certain courses and cannot change their settings, nor are they allowed to grade students. Teachers edit only those courses that they are enrolled in and they are given access to all content that can be changed, added or deleted. Students are allowed to review the courses to which they must first enroll, and it is not possible to change or edit the content of the course, but only the use of teaching materials. Guests are those users who are not logged in to the system and do not have a username and password. They can only review those courses that are not locked and are given access to review. In Merlin, there is a large number of courses, knowledge testing and user assessment, as well as learning aids that improve the user's knowledge and help them learn independently.

### **Microsoft Office 365/Microsoft Teams**

Microsoft Office 365 (including Teams) is a well-known tool for general working on computers, tablets and mobile devices. Up to 300 students or community members can access persistent chat to ensure they all stay connected either for learning or for work. Teachers have the ability to organise classrooms and assignments, collaborate and share files, and access class materials in one centralised location. Class assignments can be given and tracked.. Screen Sharing is a feature which can be allowed to all participants in a particular call. Key features for classroom collaboration include breakout rooms, which make discussions and teamwork easier by dividing the

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<sup>20</sup>new forms and ways of monitoring teaching and learning; constantly available course information; constantly available teaching materials; more e-courses in one place; visibility of e-course activities using calendars; repository of learning materials; self-assessment and review assessment; tools for communication with teachers and students

class into small groups, and the whiteboard feature, through which students can collaborate together on a shared digital canvas with Microsoft Whiteboard (integrated in Teams).

Microsoft provides extensive user guides and documentation for the use of Teams in different industries alongside education, such as healthcare, frontline workers, retails and government. Some of the education related documents can be found [here](#). On their 'Getting started with remote learning' page, Microsoft have stated that “many students who learn online say they feel they have more of a voice, and they feel more connected to their educators and peers than they did in a classroom”. While this may be debatable, especially following longer time periods of learning online, online learning platforms can provide a more student-centred approach since students can choose when and how they wish to access materials and divide their time accordingly.

### **Zoom**

Another tool, which has gained prevalence during pandemic has been Zoom. Zoom is a videotelephony software program developed by Zoom Video Communications. The free plan provides a video chatting service that allows up to 100 participants concurrently, with a 40-minute time restriction. Zoom provides its users with the following abilities: meetings and chat, video webinar, conference rooms, phone system and app marketplace. The payable plan enhances the video chatting and can also be used for teaching and learning, as it gives the option to break up the participants in the main call into several 'break out rooms'.

For example, the University of Ljubljana uses a Higher education information system (Visokošolski informacijski sistem – VIS) for the purposes of online learning. Professors can upload materials, lectures and assignments as well as publish grades and results from exams and assignments. However, this system is not directly intended to produce a more participatory approach and therefore, in the current situation, professors and instructors have had to add the use of programs such as Zoom and Microsoft Teams for the purposes of distance learning.

### **BigBlueButton**

BigBlueButton is a web conferencing system designed for online learning. BigBlueButton enables teachers to share audio, slides, chat, video, and desktop with students. Built-in polling makes it easy to engage students and record lectures. It does not require a license to use, but this platform has some drawbacks. During practical work, when more documents need to be displayed, it is necessary to disconnect the platform. There are sometimes jams, requiring disconnection and reconnection when working with a student along with a document.

### **Adobe Connect**

The *Adobe Connect* platform is attractive for synchronous communication and collaboration with students, as well as allowing students to not only hear but also see,

feel emotionally, and develop discussions through correspondence as needed. During practical classes, when explaining tasks, the use of a 'white board' has proven its worth, and the highly effective Breakout Rooms function has been used for group activities and effective group work. Students actively discuss in the 'rooms', perform tasks on the 'white board', correct or complement each other. The teacher can 'walk' through the 'rooms', advising students as needed. The *Adobe Connect* platform is best suited for working with groups of up to 50 students. It is more convenient to switch to the *MS Teams* platform with a larger number of students.

### **COVID impact to practical disciplines**

It is also interesting to explore how the pandemic has forced some courses that are very much practical and requiring face to face or hands-on practice into the digital sphere. One example is *Forest Management* (Master's Degree Program in *Forestry*). Practical work plays a vital role in studies; the "why?" elements are discussed during the lectures, but there is an additional question "how?" The preparation of an internal forest management project for real estate, in parallel illustrating the essence and purpose of the theoretical principles of forest management (for example, the provisions of normal forest theory and the advantages and disadvantages of the age class method for forest use) is simulated during the practice works. Real plot inventory data, usually obtained annually from the State Forest Service (SFS) are used there. Special tools of the SFS information system have been developed for the preparation of data. *Moodle* and *MS Teams* are used for distance learning. A description of the practical works is provided in the *Moodle* system; it is based on self-study of IT-related subjects after explaining the content, purpose and objectives of any work, presenting the input data used. It allows for a step-by-step description of the work, showing screenshots of all operations. Practice work report template combined with the job description is provided (e.g., layouts of tables or illustrations, appendices, detailed requirements for the descriptive part) there.

Examples of prepared reports from previous years, links to the legislation in order to carry out the work, databases or interactive maps, and real internal forest management projects are also provided in the *Moodle* system. Students use *ArcGIS* and *MS Excel* programs to perform the work. Typically, *ArcGIS* software is installed on each student's personal computer using a license held by Vytautas Magnus University. There are opportunities for the student to connect to computer classes remotely (but this is not encouraged in order for the student to make greater use of professional *GIS* equipment for the other study purposes as well). The performance of the work is demonstrated using *MS Teams* platform. Demonstrations are usually recorded (most students do it themselves). The products created during the demonstrations are shared with students who have the opportunity to become better acquainted with the computational algorithm. The works are done and checked by

constantly sharing the screen in the *MS Teams* platform. Work reports are presented in the *Moodle* system together with all intermediate calculation results in the form of *MS Excel* or (maps) pdf files). At the end of the practical works, during a video lecture, the lecturer demonstrates how the internal forest management project would be prepared using the SFS IS functionality. Students have the opportunity to connect from the *Moodle* system to the eFOREST.It system (a platform for the preparation of internal forest management projects for private holdings, operating on the basis of cloud computing).

So, it seems that there is a combination of digital tools that are being used during one course in order to create an optimal combination for student-centered learning and provide the best possible opportunities for students to study.

Next to aforementioned tools and platforms, there are many digital solutions that are being used by HEIs but they are not that popular or they are dedicated and suited for certain specific activities and tasks, which are not necessarily applicable to all courses and disciplines.

To explore actual student experiences and needs of learning using digital tools, as well as how they perceive best SCL practices in their universities, and compare the findings to background research, two focus groups at the University of Ljubljana in Slovenia and Vytautas Magnus University in Lithuania were conducted. The following section gives an overview of the findings.

## Focus groups

### Background on universities and participants

The University of Ljubljana consists of 26 Faculties and Academies, making it the largest higher education institution in Slovenia. The student body is diverse and comes from all over Slovenia, mostly residing in Ljubljana for the duration of their studies. The faculties and academies are distributed throughout the city and some related faculties are housed in neighbouring buildings. 7 students from various faculties across the university participated in the focus group at the University of Ljubljana. The breakdown of participant information is provided below:

Student 1 – Female – Faculty of Administration – 2<sup>nd</sup> Year Postgraduate  
Student 2 – Female – Faculty of Pharmacy – 2<sup>nd</sup> Year Postgraduate  
Student 3 – Male – Faculty of Economics – 2<sup>nd</sup> Year Undergraduate  
Student 4 – Male – Faculty of Economics – 3<sup>rd</sup> Year Undergraduate  
Student 5 – Male – Faculty of Health Sciences – 2<sup>nd</sup> Year Postgraduate  
Student 6 – Male – Faculty of Mathematics and Physics – 2<sup>nd</sup> Year Undergraduate  
Student 7 – Male – Faculty of Health Sciences – 2<sup>nd</sup> Year Postgraduate

Vytautas Magnus University is a public university in Kaunas, Lithuania, one of the leading universities in the country. It consists of 13 academic divisions, of which 10 are faculties located throughout Kaunas city, and has a student population of almost 9000. VMU prides itself on being one of the few universities in the region offering a liberal arts model of education. In the focus group conducted at VMU, the participants were 12 students in undergraduate (Biology and Genetics, Biotechnology) and graduate (Industrial Ecology, Molecular Biology and Biotechnology) courses from the Faculty of Natural sciences. The breakdown of participant information is provided below:

Student 1 - Male - Faculty of Natural Sciences - Study Programme - Industrial Ecology - 1st Year Postgraduate

Student 2 - Female - Faculty of Natural Sciences - Study Programme -Molecular Biology and Biotechnology - 2nd Year Postgraduate

Student 3 - Female - Faculty of Natural Sciences - Study Programme -Biotechnology - 2nd Year Undergraduate

Student 4 - Female - Faculty of Natural Sciences - Study Programme -Biotechnology - 2nd Year Undergraduate

Student 5 - Female - Faculty of Natural Sciences - Study Programme -Biotechnology - 3rd Year Undergraduate

Student 6 - Female - Faculty of Natural Sciences - Study Programme -Biology and Genetics - 1st Year Undergraduate

Student 7 - Female - Faculty of Natural Sciences - Study Programme -Biology and Genetics - 4th Year Undergraduate

Student 8 - Female - Faculty of Natural Sciences - Study Programme -Biology and Genetics - 2nd Year Undergraduate

Student 9 - Female - Faculty of Natural Sciences - Study Programme -Biology and Genetics - 4th Year Undergraduate

Student 10 - Female - Faculty of Natural Sciences - Study Programme -Industrial Ecology - 1st Year Postgraduate

Student 11 - Male - Faculty of Natural Sciences - Study Programme -Molecular Biology and Biotechnology - 2nd Year Postgraduate

Student 12 - Female - Faculty of Natural Sciences - Study Programme -Molecular Biology and Biotechnology - 1st Year Postgraduate

Student 13 - Female - Faculty of Natural Sciences - Study Programme -Biotechnology - 3rd Year Undergraduate

The primary target audience of both focus groups were students that are familiar with university territory (buildings, spaces, facilities, etc.) and can comment on the context and character of existing learning environments.

## Findings

### SCL methods

Students from both focus groups saw active learning methods as a normal part of their higher education process and emphasised needing an appropriate balance of active and passive learning methods in order to absorb and consolidate the information they were presented with. For students, passive learning methods allow for a deep understanding of theoretical knowledge, without which active learning would be hampered. Regarding active learning methods, project work, discussions, independent research projects, peer mentoring were all mentioned as common and effective SCL tools.

At both Vytautas Magnus University and University of Ljubljana, debates and group discussions were present and valued by students, as they allowed them to express their opinions, absorb new knowledge or test it, but also present contrary ideas and change beliefs in a well-argued way.

Furthermore, the ability to choose courses (with some degree of freedom) and study certain topics in more depth, was an appreciated active learning method in both focus groups, as such choice gave students the opportunity to pick more subjects aligned with their interests. Therefore, participants felt like it was an effective way for gaining knowledge, and they felt more motivated to study subjects interesting to them.

Another active learning method that came up across focus groups was peer mentoring systems in place at both universities. For example, the mentoring scheme at VMU provided newly joined students with support and help from seniors, making them feel more relaxed and less anxious due to its non-hierarchical structure, and participants felt could ask their peers 'stupid' questions without being judged. In addition, peer discussions may help consolidate knowledge by teaching them to explain concepts in simple and understandable ways, as well as by sharing insights gained from other learning methods.

Regarding most effective active learning methods, participants across focus groups highlighted independent work and research projects, stating that these approaches allowed them to understand course material on a deeper level. For students at UL, independent work was mostly based around reading, understanding, and discussing scientific articles which contain the most up-to-date information (both in their own time and during classes), while some participants also mentioned writing research papers as a beneficial active learning method. For participants from the Faculty of Natural Sciences at VMU, independent and research work included internships (for those in Biology and Genetics programme), field practice of animal biology and similar. According to participants, as independent research work included finding and analysing information on one's own, these practices allowed them to better absorb the material than traditional lectures, and consolidate the knowledge presented during class. Furthermore, Biology students mentioned that specialty undergraduate practice was a beneficial method for them to become familiar with research methodology and

data analysis methods first-hand, allowing them to understand it better than during traditional lectures.

In the UL focus group, computer-assisted learning came up as a favourable method for active learning, regardless of the current situation, as a large part of participants' studies is done with computers. An example of quizzes on Moodle in addition to traditional lectures was given by one student.

However, while computer-assisted learning is a good addition to higher education, the current pandemic situation has forced higher education to move online altogether, which poses certain issues for students, although it opens new possibilities for others. For more practical disciplines that require real-life engagement, online learning has created the most difficulties. A student in the UL focus group gave the example of solving mathematical equations: during in-person classes, students are often called to the board to solve equations, whereas during online lectures/practicals, it is done only by teaching assistants, which makes it less interactive. For another student in health sciences, in-person practicals were particularly important, as it was the only way that taught students how to communicate with patients and accurately convey information. Students at VMU discussed mostly in-person activities, such as practicals, applied geology excursions, and biology field practice, as most effective and beneficial active-learning methods.

### ICT/Digital learning

While most students in both focus groups were familiar with digital learning prior to the pandemic, their answers regarding ICT and digital learning were mostly related to the current context. The online learning experience was not unequivocally good or bad in the participants' eyes – it had both advantages and disadvantages compared to more traditional methods used in higher education.

On the upside, the good experiences with digital learning included things such as more time to deepen knowledge and learn better, as there was no need to travel back home after lectures at university; also, each student could incorporate recorded lectures to their schedule and learn at their own pace, going over a lecture again, if necessary. For students at VMU, digital learning helped the emergence of lecture recordings, which was previously not a common practice at the University. Participants indicated that as a convenient addition to their studies due to the aforementioned convenience and adaptability to many students' varying learning speeds and schedules.

Regarding assessment using digital tools, experiences of students differed. For one student at UL, online exams were better suited due to their flexibility, however, time restrictions per question and not being able to go back and refine answers were criticised. For another student at UL, online examinations caused additional stress related to the quality of his internet connection, rather than his level of knowledge.

Students at VMU reported that online tests somewhat improved their information absorption and were less stressful than traditional ones (easier correction, faster writing pace), however, they had concerns that potentially less information would be remembered for long periods of time.

However, students also had numerous negative experiences with digital learning. Overall, it stood out that online learning required more personal motivation and effort compared to traditional learning, as motivation and concentration levels were lower during the pandemic. Thus, it is unsurprising that students adapted differently to the new normal: while for some online learning via Zoom was too burdensome, resulting in less activity during class and lower quality discussions/debates, for others, it was an opportunity to become more active in lectures and practicals. While UL focus group participants agreed that they did not see a decrease in quality of teaching during the shift to online learning, there was a decrease in knowledge and overall motivation. This was particularly important for those studying practical subjects requiring in-person learning such as laboratory work or clinical practice, as online learning cannot replace such practice to an acceptable level.

Regarding online learning and physical space, students across focus groups indicated that studying at home made them more prone to distractions and required more active effort, as well as complicated their ability to concentrate for longer periods of time. Moreover, it was noted that not all students may have adequate study conditions at home/place of residence. Physical presence at the university/faculty was not only important to students as a place to focus but also as social space allowing students to socialise, form friendships and networks, and find extracurricular activities. With that in mind, the hybrid teaching system was brought up during the UL focus group, as a potential way for students to be able to choose their preferred method of learning, as both teaching and learning styles vary greatly across students and faculty members.

Regarding specific digital tools, Moodle was the common denominator in both focus groups. The University of Ljubljana has a full Zoom licence for both staff and students and therefore it is not surprising that all participants mentioned that Zoom is the dominant digital tool used. Microsoft Teams and Webex were the other video conferencing systems mentioned, however participants said that the use of these is rare. Kahoot, a game-based learning platform, was also mentioned as a tool which some professors use to diversify lectures and practicals. At VMU, several students gave priority to the combination of Moodle and Big Blue Button distance learning platforms. The Big Blue Button platform was referred to as a reliable and simple enough distance learning platform. Also, several students mentioned Adobe Connect as a platform they liked. The rather widely used MS Teams program was not so popular because it had more problems with presentations.

## Physical design

While discussing physical design, students at VMU mentioned that a student-centered learning environment should be an environment that is tailored to students with a variety of available needs. A great student-centered environment should, first of all, meet their physical needs (the university should have a canteen for students; a cloakroom; possibly code lockers; a leisure room; drinking water stops; the working hours of the spaces should be flexible, perhaps even 24 hours a day, in order to adapt as much as possible to the needs of a dynamic young person). And, of course, the spaces should be adapted for students with mobility or visual impairments. In addition, students from the UL focus group understood the SCL environment as a space, which enables both individual and group study sessions, where you can grab a coffee/refreshment nearby and students can be there all day, as many students prefer to go to one space and they there throughout the day, in order to be as productive as possible. For another student from the same group, the key factor was the brightness of the space, where people are able to communicate with others, if they wish, and that at the same time spaces have enough separation between them, so that you do not have to listen to others' conversations. Similarly, students at VMU mentioned that the auditoriums should be ventilated, have the appropriate room temperature, good visibility and layout of the study places (it should be possible to see the lecturer clearly and not clutter with other students – there should be space not only for a notebook, but also a computer). Thus, we can see that flexibility, adaptability to many different needs, comfort, and the space being inviting for students to participate in different kinds of activities, both individual and group, are key factors for a good SCL environment.

At UL, an example of a good SCL space was described as a 'Cube of Knowledge' (<https://efnet.si/2018/01/kockaznanja-cek/>) (photo below). These spaces can be used for students for both individual work and group projects. They are equipped with a table, between 4-6 chairs, a white board and computer screen, which students can connect to their own computers. Student 3 reported that he has found the use of such spaces very enjoyable in the past, since they allow for productive study sessions with other students. He has also found them quite entertaining in the past and said that students pretend to be professors, while writing on the board. However, the number of these spaces is very limited and not widely available, especially during exam season. Such 'Cubes of Knowledge' were also mentioned as spaces encouraging student collaboration. Other students from the UL focus group mentioned different seating options in their respective faculties, especially when it comes to the areas outside of lecture halls and seminar rooms. While they recognised this as a helpful piece of the environment, they also noted that it is not exactly the space that they would consider appropriate for longer study sessions as most of them are located in busy corridors. One student has also used the dining room as a study space and potential quiet parts of the corridors, which are mostly equipped with at least a table and some chairs or benches.



At VMU, student collaboration and learning was particularly encouraged by places in libraries for small-group work. Leisure spaces and spaces where student organizations are located were also very important, as these were spaces where students could boldly express their thoughts and share their ideas (which can sometimes turn out to be frivolous or idiotic) make discoveries. Such spaces open the door for students to communicate and get to know senior/advanced students, thus sharing mutual experiences.

When asked about ideal SCL spaces, students from the VMU focus group described it as a cozy room with comfortable furniture suitable for sitting, studying, good lighting, equipment for warming up food and cooking (microwave, teapot), accessible books, magazines, board games. It could include study-related attributes, elements that allow you to test your knowledge in your free time (for example a microscope available at the Faculty of Natural Sciences, or a drawing board available at the Faculty of Arts). For students at UL, however, it was difficult to provide concrete examples and they stated that it is hard to imagine due to the fact that most of the faculties do not have space to expand. Older buildings were also understood as not designed with the students in mind, lacking space to comfortably wait for lectures or practicals. One student gave the example of the newer building of the Faculty of Chemistry and Chemical technology (construction finished in 2014), which provides these spaces and has the “Cubes of Knowledge”. She noted that it is important to give students both the option of study spaces as well as areas, where they can be social and interact with their peers. In addition, student 3 said that for him personally the “Cube of Knowledge” is the best solution, but there could be something better, which he is not aware of. Student 4 agreed and added that a potential bonus would be better sound isolation in some spaces, since sounds are the most disturbing for his concentration.

Regarding practical disciplines, the UL focus group brought up the need for wider access to equipment, potentially provided through some kind of reservation system embedded in the University’s online environment, which would allow the faculty a

higher degree of control over expensive and delicate materials. Similarly, participants at VMU mentioned that laboratories for practical work should be safe, tidy and spacious. Each student should be given his or her practical workplace, the necessary tools, reagents, and the opportunity to do all the practical work individually rather than in groups. There was also a need for separate facilities and a laboratory for members of the Students' Scientific Society, both for their own research and for the organization of science promotion or educational activities.

Overall, students thought that current facilities at both UL and VMU were not particularly student-centered and could be further improved. At UL, a few of the participants pointed out that most areas intended for student use are too small for the number of students per degree programme/faculty. Student 1 said that while she enjoys the semi-circular tables in smaller seminar rooms, there are not enough spaces for individual studying and that the library does not provide enough spaces. She gave an example from her faculty, where there is an open lecture room, which students can use freely. However, it bothers her that there are not more such rooms, however added that she knows this is purely for security reasons. The latter was also mentioned by Students 2 and 5, with Student 5 adding that some teaching rooms are available to students, but only with prior agreement with a professor. These rooms are equipped with the tools students need to practice their skills. Student 5 gave the example of physiotherapy tables and x-ray machines. Student 2 said that in her faculty there is only one study room with approximately 30 seats and a large table with two benches in one of the corners, which is not nearly enough for all students. On the issue of size, Student 4 pointed to the fact that there is always the option to study at NUK (Nacional University Library), however, it is in the centre of the city, which is not always convenient, and capacity is quickly met during exam season. All of the participants mentioned that, if more study spaces were provided, students would undoubtedly use them. The issue of availability of spaces was also present in the VMU focus group: according to the participants, the university lacks leisure rooms or facilities where you can spend your free time between classes and discuss with other students. In addition, they brought up the issue of facility opening hours, as current ones do not meet the varying needs of students.

## CONCLUSIONS

In conclusion, current research has allowed us to compare existing literature and good practices with actual student experiences and needs regarding SCL. When it comes to SCL methods used in education, active learning methods were widely used and appreciated by students, as they helped them understand and consolidate knowledge better than traditional teacher-centered methods. Focus group participants frequently mentioned independent work, research projects, discussion and debate groups, peer mentoring schemes, the ability to choose their courses, and practical experiences such as fieldwork or internships as the most beneficial approaches to discover new insights and deepen their knowledge in the study subject.

Computer assisted learning was another active learning method that students engaged in, even before the pandemic, however, for more practical disciplines, it lacked interactivity and some key elements that could only be delivered through in-person classes. Thus, going forward, it is crucial to find a balance between digital and in-person learning based on specific disciplines and student needs, as mis-application of digital learning methods may hamper the learning process instead of complementing it.

Aside from that, the digital learning experience had both upsides and downsides for the students. On the one hand, the flexibility provided by lecture recordings and adaptability to different student schedules was noted as one of the most valuable additions of digital learning to the higher education experience.

On the other hand, participants noted that online learning required more individual effort, as they noticed decreased motivation and concentration while studying online. For some, digital lectures (e.g. on Zoom) were burdensome and decreased their participation and ability to have fruitful discussions with their peers, as well as develop bilateral relationships with their lecturers, while yet others felt an improvement in their participation. Another important finding was that online learning creates new issues for students that did not exist before: the home environment is often more distracting than studying in dedicated university spaces, and some students may not have the appropriate conditions (e.g. silence, good lighting, stable Internet connection) to study at home. Therefore, study spaces remain as important as ever: they are not only a physical place where students can study productively, but also spaces for community building, socialising, networking, and sourcing extracurricular activities.

Some students mentioned a mixed online-in-person approach as a possible solution to adapt higher education to a diverse set of needs, however, this shows that design of physical spaces is not any less important to a student-centered approach. Overall, participants felt that their current university spaces were not particularly SCL-friendly and could be improved. For one, physical needs of students (e.g. drinking water stops,

leisure rooms, good lighting, adaptation to those with visual or mobility impairments) should be taken into consideration. Working hours of university facilities should also be longer, perhaps even around the clock, to adapt to dynamic students' needs. Then, SCL spaces should be designed in a way that encourages and promotes communication and collaboration between students in a flexible way: students should be able to interact with others or separate the space if they do not want to hear others' conversations.

Examples of good student-centered spaces within UL and VMU were discussed in the focus groups, uncovering that key elements were flexibility of the space which allowed for both individual and group work, technological access, comfort, and interaction between students. However, a common problem was that study spaces, as well as leisure rooms or spaces to spend time between lectures were very limited in capacity and there were not enough for all students who would like to use them. Thus, for good SCL design it is important to take into account not only lecture halls and libraries, but also leisure spaces where students can socialise, spend their free time, and build community around them.

