iLikeIT2

Learning Through Innovative Collaboration Enhanced by Educational Technology

Pedagogical strategy for implementing Educational Technology in the classroom

- Especially directed towards collaborative work

Parts of this Intellectual Output is co-funded funded with support from the European Commission through the project *Learning Through Innovative Collaboration Enhanced by Educational Technology* (iLikeIT2) (Nr. 2020-1-NO01-KA203-076434).

For further information and contact, please visit our website at https://ilikeit2.eu/

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

iLikeIT2

Learning Through Innovative Collaboration Enhanced by Educational Technology

Partners

COORDINATOR NTNU	**Norwegian University of Science and Technology (NTNU)** Norway https://www.ntnu.no **Tord Mjøsund Talmo: tord.m.talmo@ntnu.no**
fyg consultores	**Instalofi Levante Sl** Spain http://www.ariscy.com Aleksandra Staszynska: aleksandra.s@fygconsultores.com
Συνεργασία Ενεργών Πολιτών	**Active Citizens Partnership** Greece http://activecitizens.eu/ George Bekiaridis: George.bekiaridis@gmail.com
Middlesex University London	**Middlesex University Higher Education Corporation** The United Kingdom https://www.mdx.ac.uk/ George Dafoulas: g.dafoulas@mdx.ac.uk
cesie the world is only one creature	**Cesie** Italy https://cesie.org Ms. Alessia Valenti: alessia.valenti@cesie.org

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

iLikeIT2

Learning Through Innovative Collaboration Enhanced by Educational Technology

Contributors

Tord Talmo, NTNU

Robin Støckert, NTNU

Jon Eirik Hennissen, NTNU

Alessia Valenti, CESIE

Jelena Masaj, CESIE

George Dafoulas, MUHEC

Maria Sapountzi, ACP

George Bekiaridis, ACP

Miriam Fernandez, FyG

Begona Gonzalez Ricart, FyG

Table of content

Abbreviations

HE(I)	Higher Education (Institutions)
LMS	Learning Management System
VET	Vocational Education Training
MOOC	Massive Open Online Course
RT	Response Technology
f2f	Face to face teaching, physical presence
Hybrid mode	Divided student group between online and physically present students
AV	Audio- Visual
U-learning	Ubiquitous Learning
mLearning	Mobile Learning
SoMe	Social media, like Facebook, SnapChat, Whatsapp or similar.
PST	Pedagogy-Space-Technology framework.
iLikeIT2	Learning Through Innovative Collaboration Enhanced by Educational Technology
21st Century Skills	A set of skills defined by the European Commission to describe what is necessary to focus on to coop with new demands in the modern age.
ICT	Information and Communications Technology
STEM	Science, Technology, Engineering and Mathematics
GDPR	General Data Protection Regulation
TEP	The theory of electronic propinquity
GIF	Graphics Interchange Format

Background/rationale

Digital skills are vital 21st-century skills and are much appreciated in the educational sector. Moreover, it is also needed. Worldwide demand for higher education is expected to grow exponentially from 100 million students today to 250+ million by 2025[1]. The big question is how higher education institutions (HEIs) will sustain and improve the quality of the learning experience in the face of continuing growth and diversity in the student population.

HEIs are facing considerable challenges too significant to be dealt with by one country acting alone: the economic crisis; unemployment, especially for young people; changing demographics; the emergence of new competitors, and new technologies and modes of working[2]. In addition, new student groups want relative, timely, available on-demand education that fits a specific need.

For these reasons, we also see a shift in HEIs from traditional colleges to more interactive, technology-inspired, and internationally oriented institutions. The project Learning Through Innovative Collaboration Enhanced by Educational Technology (iLikeIT2) addresses these new needs and focuses on using mLearning and Educational Technology (Ed. Tech) tools to use in class.

Technology is nothing without methodology, however. "Pedagogy and technology intertwine in a dance: the technology sets the beat and creates the music, while the pedagogy defines the move."[3]. Therefore, the project will focus primarily on methodological guidelines and new interventions toward practices in HEIs in the digital era, where iLikeIT2 aims to design its own tool for collaborative work in class. By using the best from already available tools and utilizing this in collaboration between programmers and end users, iLikeIT2 fulfills al functionality needed to make the methodology sound and applicable at all levels of the educational system.

One key aspect of the change toward 21st-century skills is the ability to work in groups. The United Nations Educational, Scientific and Cultural Organization (UNESCO) points to this fact in their report series Education Research and Foresight from 2015: "The collaborative learning environment challenges learners to express and defend their positions, and generate their ideas based on reflection"[4], and connects the emergences of new digital innovations: "With the development of new ICTs innovative forms of collaboration are also emerging (Leadbeater, 2008, p. 10)[5]"

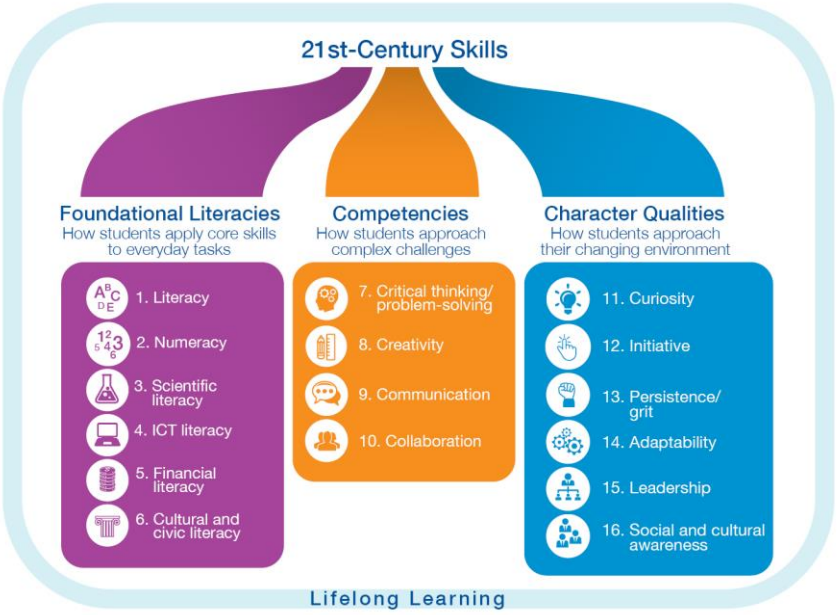


Figure 1. World economic forum 21st century skills

Project summary

Getting students involved in discussions with peers and the teacher is often demanding in a classroom. Some students seldom raise their voices, discuss, or enhance their analytical and social skills in an academic environment. There have been and are many initiatives to overcome this challenge. Educational technology and collaborative work are among these, and both have proven effective. Educational technology has the advantages of involving students, raising engagement and motivation, enhancing peer learning, and ensuring easy diagnosis for the student groups when used correctly. It also provides the lecturer with possibilities of facilitating the usage of Ed. Tech, easy integration within lectures, and giving immediate feedback to the group. Collaborative work has the advantages of enhancing social skills, redirecting educational and social strategic goals for the students, and enhancing the learning environment.

iLikeIT2 wants to combine all these advantages and develop an online application with appropriate methodological guidelines to easily enable lecturers to quickly and efficiently connect students in a randomized group and receive responses from all participating students. The students will be able to discuss the task provided by the teacher with peers and try to agree upon a solution. This answer will be submitted and objected to for plenary discussions facilitated by the teacher. iLikeIt2 will be a variation to the traditional group work, where anonymity and written language are targeted more than physical contact and verbal expressions.

The concept development and prototype application will be achieved through research-based approaches, redeveloping an existing tool, and providing all outcomes for free to all interested parties. The consortium, consisting of five partners from Norway, the United Kingdom, Italy, Spain, and Greece, with strong networks both in higher education, lower levels of the school system, and in the Vocational education and training (VET) sector, has extensive expertise and experience in transnational projects, and the scrum management method implemented in the project is to ensure all partners can utilize their internal strengths.

The project mainly targets Higher Education Institutions because the challenges with collaborative work are more prominent when the groups are large and the academic tradition is conservative. However, the project develops universal methodology and tools that can quickly adapt to other sectors, both educational and entrepreneurial.

The project will produce tangible results that can be used and implemented directly during and after the project's end. The main results will be a functioning prototype of a response tool, including functionality for randomizing the group, requesting feedback, and manipulating results directly at a plenary meeting after the voting ends. Technology is nothing without methodology, though, and the consortium will direct its main effort toward making guidelines and a pedagogical strategy for making helpful software for teachers and students. It is also necessary to sustain the system and increase the impact, which is why the consortium includes technical specifications and an adoption strategy to disseminate and sustain the results further.

The project activities include research to validate the outcomes, pilots of parts of the output or the whole output, and multiplier events to disseminate. Also, the development and testing of the new software will be ongoing for the whole period.

iLikeIT2 has the potential to impact all of Europe and many different sectors of the Educational System. It will benefit all institutions providing education, no matter the size of groups, and will contribute to a change in how we do collaborative work with student groups.

Intellectual Outputs

The iLikeIT2 project consists of four different Intellectual Outputs, i.e., tangible results free for all interested parties, accessible through iLikeIT2.eu:

IO1 – Report

In the first phase, the consortium researched the available tools in the digital market to see which functionalities might help create more collaboration in a learning environment using digital tools, summarised in a report including viable tips for using and utilizing digital tools when working collaboratively.

The report is available at https://ilikeit2.eu/wp-content/uploads/2022/03/iLikeIT2_IO1_2.0.pdf.

IO2 – Pedagogical strategy

In the project's second phase, the consortium created a pedagogical strategy for using digital tools, especially response tools, in collaborative settings. The strategy aims to include all aspects needed to implement these tools in the learning environment. The strategy includes a pedagogical framework, a discussion considering different areas related to various levels, different types of education, different delivery moods, and concrete examples and cases developed for different educational levels on how to start using digital tools in a learning environment. This manual is the result of this work and is available online via https://ilikeit2.eu

IO3 – iLikeIT2

Based on the result from the two first phases, iLikeIT2 aims to create new and innovative software built on the ideas of response tools but with additional features providing opportunities for students to collaborate and interact before answering the questions/cases. This software, iLikeIT2, will enable instructors to create groups and facilitate learning easily and time efficiently. The software can be downloaded free of charge at the website ilikeit2.eu

IO4 – Methodological guidelines

Technology is nothing without methodology. Thus, the project provides methodological guidelines for using our software in collaborative settings. The guidelines are illustrated, recorded, exemplified through different cases, and downloadable as PDFs. The methodological approach builds on the findings in the previous phases of the project. Therefore, we recommend looking at the examples to best succeed with the implementation. The methodological guidelines will also be available at the website ilikeit2.eu

has the advantages of involving students, raising engagement and motivation, enhancing peer learning, and ensuring easy diagnosis for the student groups when used correctly. It also provides the lecturer with possibilities of facilitating the usage of Ed. Tech, easy integration within lectures, and giving immediate feedback to the group. Collaborative work has the advantages of enhancing social skills, redirecting educational and social strategic goals for the students, and enhancing the learning environment.

Part A: Theoretical framework

Educational technology

Though most agree upon the term's central elements, there are diverse ways of defining Educational Technology (Ed. Tech). A simple definition on Wikipedia states, “Educational technology is the combined use of computer hardware, software, and educational theory and practice to facilitate learning”. However, often the focus is on the tools to facilitate learning, even if this definition includes theory and practice. In their book (2008), Januszewski and Molenda discuss the definition even further, including more aspects like ethics, improving performance, management, and coordination, which differ between processes and resources[6]. This approach is more beneficial for an instructor and stresses that technology is not the aim itself, but technology combined with pedagogical facilitating helps enhance learning in an environment designed for the purpose. Several studies have proven that the usage of Ed. Tech in a learning environment has some restrictions but might also benefit the learning of curricular elements [7]. Considering the rapid change of the learning environments in today’s society, even seeing how technological competence is considered one of eight key competences in the European Framework for lifelong learning, Ed. Tech needs to be defined, researched and implemented soundly in the future.

When we talk about Educational Technology, we include several technologies which may be appropriate for educational purposes: Handheld devices, learning management systems (LMS), MOOCs, social media, response technology, messaging systems, and more. We will also include processes designed for using the tools and methodologies for implementing technology to raise awareness and improve skills in using Ed. Tech.

Learning environment

A definition of learning environments often refers to the diverse physical locations, contexts, and cultures in which students learn, including all varieties of both online and physical environments where learning happens, intentionally or unintentionally[8], [9]. These definitions recognize that learning appears in many ways and contexts, removing the excluding focus on a classroom as the only place where learners achieve academic standards. Hence, more learning styles can be addressed and included in the environment. We know that learners do not learn the same way, which means that the design, implementation, and use of the environment must support the learner's needs without losing focus on the importance of the teacher's teaching style.

We differentiate between three types of learning environments: physical teaching or face-to-face-learning, online teaching, and hybrid teaching (read more on the different delivery modes later in the document). In all three, we must consider the role and importance of digital tools. In this pedagogical strategy, we implement the framework from Gilly Salmons's e-tivities[10]. According to Salmon, there are five stages of development that a learner in an online community needs to go through and that the lecture designer needs t2o aid in fulfilling. (Fig2)

Even if we are not solemnly discussing and recommending elements for online training, many parts of Salmon’s framework are crucial in any learning scenario; thus, the framework is a suitable anchor for our thinking. As in designing educational software, also when it comes to teaching, there needs to be a close interaction between the lecturer, technical support, and the learners themselves if one is to utilize digital tools to their fullest potential. When teaching or learning with digital tools, one must define the infrastructure, such as class size, designated teachers, choice of Learning Management System (LMS), and student workload throughout the week—using the tools and their features to

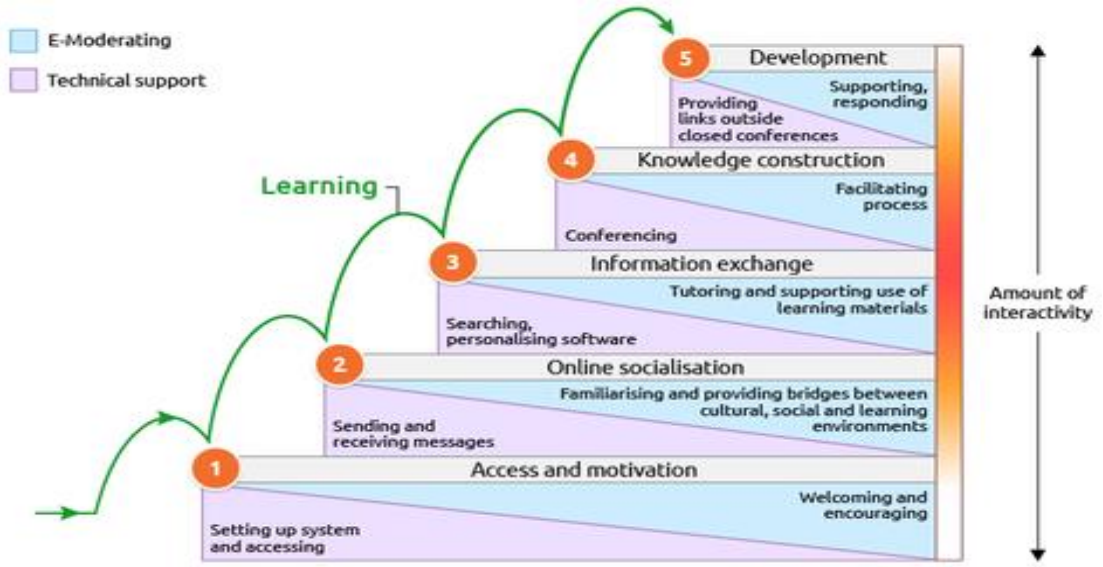
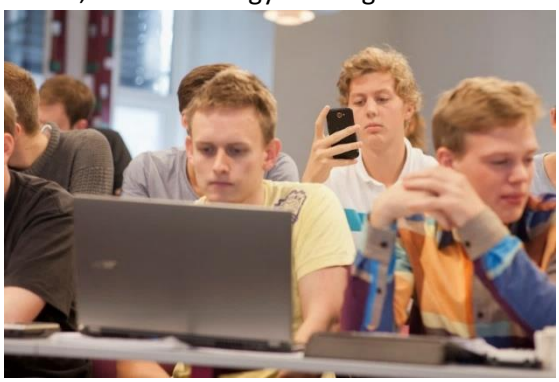


Figure 2. Salmon`s five stages of successful online learning implementation. https://www.gillysalmon.com/five-stage-model.html

facilitate reasoning, background theory, or statistics. Hence, making the learners familiar with the tools and motivated to participate more actively to gain any effect or outcome of the applied digital tools. In addition, one needs to find suitable means of monitoring and facilitating the collaborative work through instructions, communication, and assessment, and one needs to consider e-moderating elements, like AV-structures, cases provided, and materials prepared for the learner's use. Overall, this framework is helpful for novice teachers without overall digital competence and can provide new ideas and approaches for more digitally experienced teachers.

Mobile learning:

The rapid change in society and especially the emergence of mobile technologies (i.e., tablets, computers, and smartphones) are changing our communication and how we interact and teach. Some might even claim how we think about the learning processes. Not long-ago mobile technologies and digital devices were used in educational contexts just for a limited number of activities and mainly as an alternative way to get access to learning materials, for example, to watch short videos or access written material in places other than the office, classroom or at the stationary computer at home. Today we see those handheld devices, and the vast number of apps, software, and communication tools have become globally dominant. According to Traxler, ICT technology and digital devices are overtaking and invading every part of our everyday life. The technologies are “curiously both pervasive and ubiquitous, both conspicuous and unobtrusive, both noteworthy and taken-for-granted in the lives of most people”[11], infusing how we teach/lecture and how students learn. We see an increased amount of literature and studies on the effects of mobile learning and more and more evidence that mobile technologies can enhance and even transform learning and teaching experiences in many ways. Mobile technologies “enables teachers to design for learning beyond the boundaries of their institution”[12], [13]. Thus, when designing for the future classroom and considering collaborative work, one must advocate for including mobile technologies.



Response Technology

Response technology (RT) is not necessarily new in the learning environment or society. Since the early 80`s, instructors and gameshows have been using so-called clickers, often connected to a base that needed to be installed manually in the room. In the latter 20 years, more and more of these technologies have moved to mobile devices, such as laptops, tablets, and smartphones, providing the ground for more advanced RT systems using the student's own devices (bring your own device, BYOD) and research on developing a related sound pedagogy. Einum (2019) shows that response technology can significantly benefit students' active participation in all subjects[14]. Not only do RT engage the students in the curriculum, but it can also enhance an idea of student-centered activities: "The motif of the teacher as a facilitator and collaborator is therefore central to student-centering (sic.), with the teacher engaging with the students to negotiate their internal perceptions….

Response technology may actively involve the students in the learning, allowing learners to engage with curricular elements, argue theoretically for their beliefs, and use their argumentation to advance existing knowledge and create new tasks based on previous results. Thus, RT is a brilliant pedagogical element to include and use in a learning design to enhance active learning.

Active learning

Active learning has become increasingly popular in recent decades, even if it is not new. Involving students, allowing them to figure out problems independently or with peers, and engaging them in how the curriculum is taught, have always been a part of the HEI's learning strategies. Even so, the theory of what works and why it works has led to a heightened emphasize on actively engaging students in their learning process. We will rely on two proven fruitful approaches that can be empowered by applied Ed. Tech.

Inquiry-based learning[15] is rooted in constructivist learning theories. Savery (2006) describes inquiry-based learning as "a student-centered, active learning approach focused on questioning, critical thinking, and problem -solving. Inquiry-based learning activities begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new-found knowledge"[16]

Inquiry-based learning is considered a response to traditional forms of instruction deeply rooted in constructivist learning theories. It represents a tool for a problem or task to trigger student engagement [17] and fosters students to be more reflective and self-regulated in their learning

processes. As a part of an active-learning approach, inquiry-based learning was and is an alternative to more formalistic and conservative learning theories.

The theory on self-regulated learning might be as enjoyable. An essential argument for students' learning and development as students throughout their study life is their ability to self-regulate and understand their learning process: "Self-regulated learning strategies refer to action and processes, directed at the acquisition of information or skills that involve agency, purpose, and instrumentality perceptions by learners."[18]. Other elements within the strategies might contain the ability to access curricular elements, adequately treat curriculum and learn how to study efficiently. It most certainly includes an ability to understand better how to learn more efficiently and with peers in a group. In order to benefit the most from collaborative work, the students need to be trained in processes and ways of achieving learning objectives actively. Consequently, it will ensure a more active role and participation from more students in collaborative work.

Considering the inclusion of digital tools in collaborative work, the pedagogy implemented must also be aware of pedagogical aspects connected to modern technology.

When applying mobile technology and RT in education, it is natural that it is at hand and easy to use in various learning scenarios, whether student- or Teacher-led. The learning scenarios and related activities can be represented by the Learning Spectrum, designed by Wilson Architects and presented by Radcliffe(2008) in his PST framework.[19]

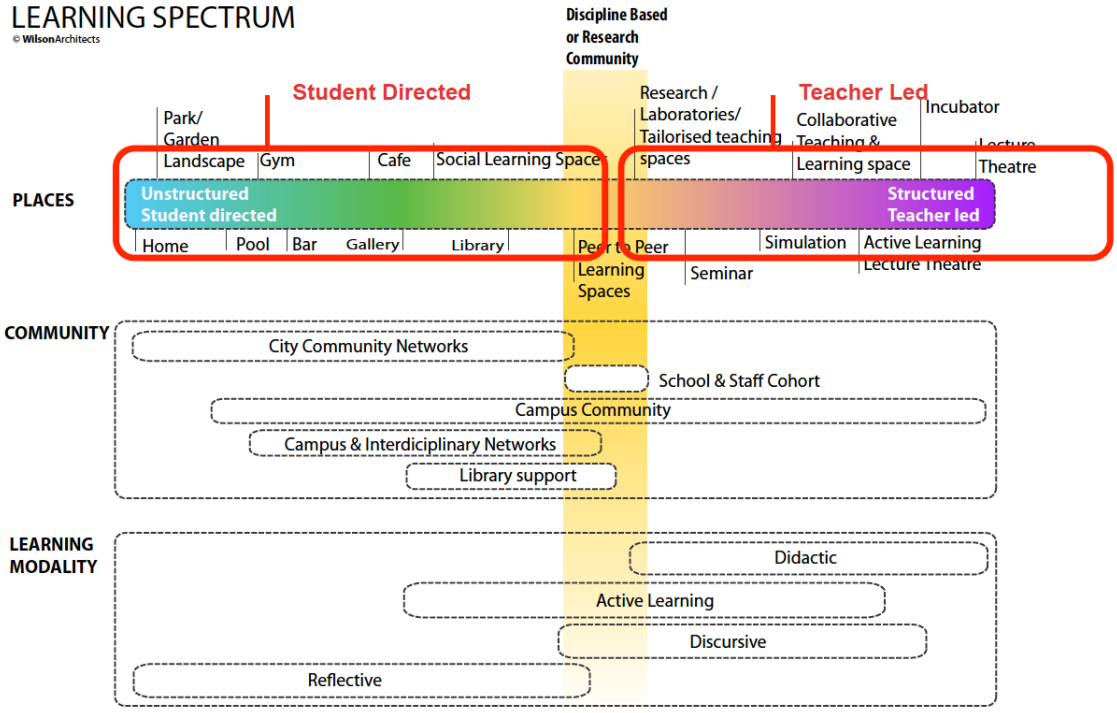


Figure 3. Wilson Learning Spectrum

Based on the learning Spectrum, we can introduce the idea of ubiquitous learning, also known as u-learning. U-learning, described by Yahya et al. (2010), builds on ubiquitous computing[20]. The basic idea is that learners must be enabled to learn anywhere at any time, utilizing the tools available in real-life scenarios. For example, can we see more and more adult learners being able to use Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) combined with new arenas like the MetaVerse which allow you to explore virtual 3D spaces where you can socialize, learn, collaborate and play. The technology also brings us new tools, like ChatGPT, and various AI-based software like MidJourney, making it easier to obtain information and create and develop ideas through any format, like video, text, image, and music. Furthermore, to run simulations or experiments or to build digital twins (A virtual model designed to reflect a physical object accurately.)

Collaborative learning

In order to have a successful implementation of online learning environments, it is necessary to encourage students to actively participate and create a sense of belonging to a community of learning. “In the new culture of learning, people learn through their interaction and participation with one another in fluid relationships that are the result of shared interests and opportunity”[21]. Here we might find the essence of collaborative work. The participants must be engaged, involved, and motivated to do their part. We can contrast collaborative work with cooperation. Whereas the latter is characterized by group members working on different sub-tasks and, in a learning exercise typically

being assessed individually on their part delivered, collaborative work is defined by members of the group working together on the same task at the same time, and thus also being assessed as a group.

When applying digital tools in the learning environment, providing tools that allow for collaboration, such as video conferencing, chat functions, co-writing, common focus points (shared work surfaces like interactive whiteboards), and coordinative elements like shared online file structure (LMS) and storage, is essential. If several of these elements are missing, there is a huge possibility that the group will move from collaborative to cooperative work fast. For example, the article from Talmo et al. (2012) shows an implementation of group work that ensures participation from all members through a shared physical interactive whiteboard where all members collaboratively engage in the task given[22].

Digital competencies:

In the modern age, students and teachers must be ready to utilize the new opportunities as best as possible. The JRC (Joint Research Center) of the European Commission has developed a framework for the competences needed in the modern age called *Digital Competence Framework for Educators* (DigCompEdu)[23]. It provides a general reference frame to support the development of educator-specific digital competencies in Europe. Furthermore, it helps teachers/trainers discover the level of their personal Digital Competences and provides recommendations on developing further.

The framework comprises 22 competences divided into six categories or areas, focusing on different aspects of educators' professional activities. These involve all aspects of using digital tools, from actually using a tool in class to ethics and didactics for enhancing the learning experience.

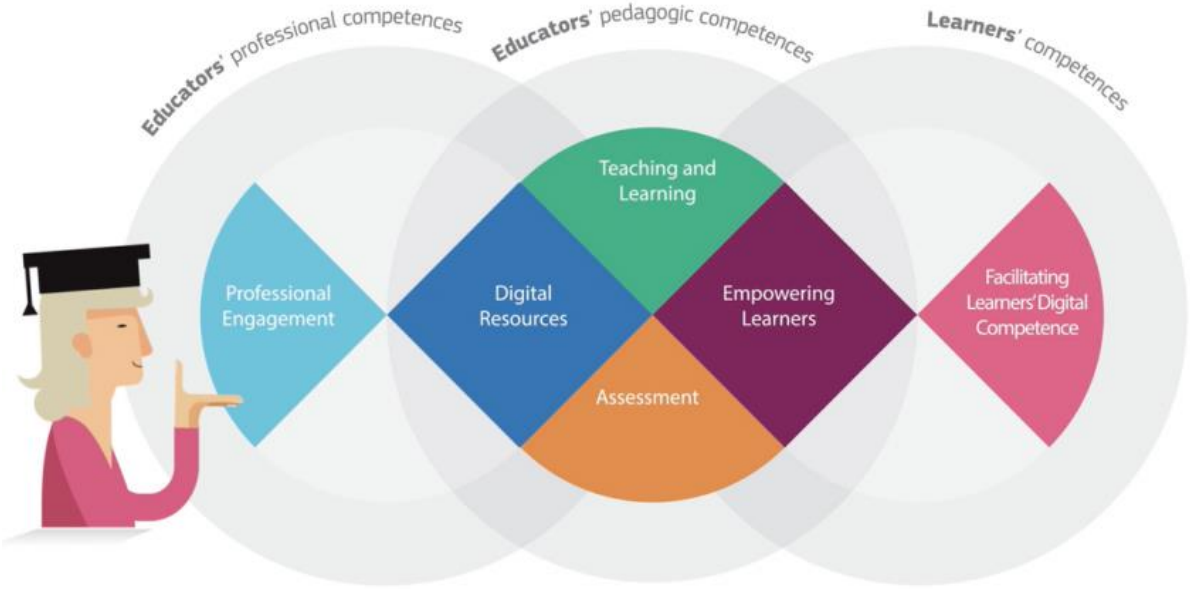


Figure 4 Visualization of the competences in DigiCompEdu
https://joint-research-centre.ec.europa.eu/digcompedu_en

The framework includes an explanation and idea on how to enable and engage students in the learning process found in the fifth area (*Empowering learners*) and especially the part on "5.1 Accessibility & Inclusion" and "5.3. Actively engaging learners".

Regarding accessibility and inclusion in the learning process, teachers and educators should remember that generally, all learners, regardless of their digital competencies or learning disabilities, disabled or not, should be included in the learning resources and activities. Additionally, they are responsible for answering to their "(digital) expectations, abilities, and misconceptions, as well as contextual or physical constraints to their usage of digital technologies".[23]

Methodologies and strategies, such as assistive technology, could assist learners with special needs support, specially designed for such people. Disabilities refer to the area of learning disorders and physical or mental restraints. Another option could be alternative and compensatory tools for "selecting, modifying, or creating digital resources"[23]. Finally, it is advisable to create and apply basis and ethics for increased accessibility during the inclusion process and to constantly monitor and echo the suitability of these taken measurements to provide accessibility in the learning process.

The part of actively engaging learners includes the process of fostering learners' active and creative engagement with a specific subject. Digital technologies should be used to promote learners' critical thinking and creative expression within the pedagogical content. Activities for engaging learners in the learning path may include:

- Use of animated videos to visualize and elaborate new topics in alternative and engaging ways.
- Use games-based activities like quizzes and puzzles or apply strategic game mechanics (points, rewards, leaderboards) to increase engagement and motivation.
- The practical and active usage of digital tools is the revolving center of the instructional process. Therefore, the learners could easily be engaged through digital technologies and use various senses, influence objects virtually, alter the set-up of a problem "to enquire into its structure, etc."[23]
- Selecting the most appropriate and suitable digital technologies according to the subject and the learners' needs is one of the most crucial points in the learning process.

Finally, the educators and trainers should be able to mirror and give feedback on the suitability of the digital technologies used during the lectures and the courses.

The image is from a presentation at the 2023 HCI conference workshop W3: "*Inclusive Design of Educational Technologies to Support Students with Specific Learning Disabilities in Higher Education*", where iLikeIT2 participated and co-present the movie documentary and a related poster/paper published in "HCII 2023 - Late Breaking Work - Posters" Springer CCIS volumes of the Proceedings.

https://vimeo.com/792160236/f6854db765

Formative assessment

In traditional pedagogical thinking, we often separate the assessment of students' performance into two categories; 1) Summative assessment and 2) Formative assessment.

A summative assessment evaluates the student's progress at the end of an assignment or test, while a formative assessment is supposed to monitor the progress throughout the assignment, thus allowing for corrections during the period. Both ways of assessing are necessary and valuable when considering collaborative work, especially to allow all students to show their strengths. However, formative assessment in collaborative work seems most beneficial, including "active learning" based on inquiry.

In a broad sense, assessment is " the act of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made."[24]. In a learning situation, this will include everything the learners and instructors do to get information, learn better, and engage in curricular activities.

According to Carol Boston (2002) assessments become formative when "the information is used to adapt teaching and learning to meet student needs."[25]. Hence, Carol confirms our earlier statement that the learner's needs must be included in the progress of collaborative work and also include some form of evaluation based on how the learners are handling and including the elements introduced to them during the time allocated for the assignment, as well as the final results produced by the group.

Consequently, these measures might enhance collaboration, communication, and coordination within the timeframe of the assignment, which are all essential to reach a higher level of learning than possible when doing the same work individually. Hence, it is reccomended to use formative assessment when doing collaborative learning using digital technology.

Modes of delivery

The fundamental elements or building blocks to construct and deliver a functional learning environment are consistent through the different levels of the educational system. Schematically, these elements are represented by applied pedagogy and technology within a learning space. In addition, it is necessary to add the human factor as an essential component, interacting with these elements.

Nevertheless, the pedagogical strategies applied are essential to success, hence a natural starting point (top point) for a holistic learning environment design using the Pedagogy-Space-Technology (PST) framework[19]. The framework represents an iterative simple but scalable process, providing a common understanding by all stakeholders, and is relevant throughout the lifespan of learning spaces, whether a physical, hybrid, or online learning space.

In our case, we aim to facilitate and improve collaborative work, and also in this case, pedagogy should be the logical starting point, and then relevant technology should enhance and facilitate the collaborative work within the learning space.

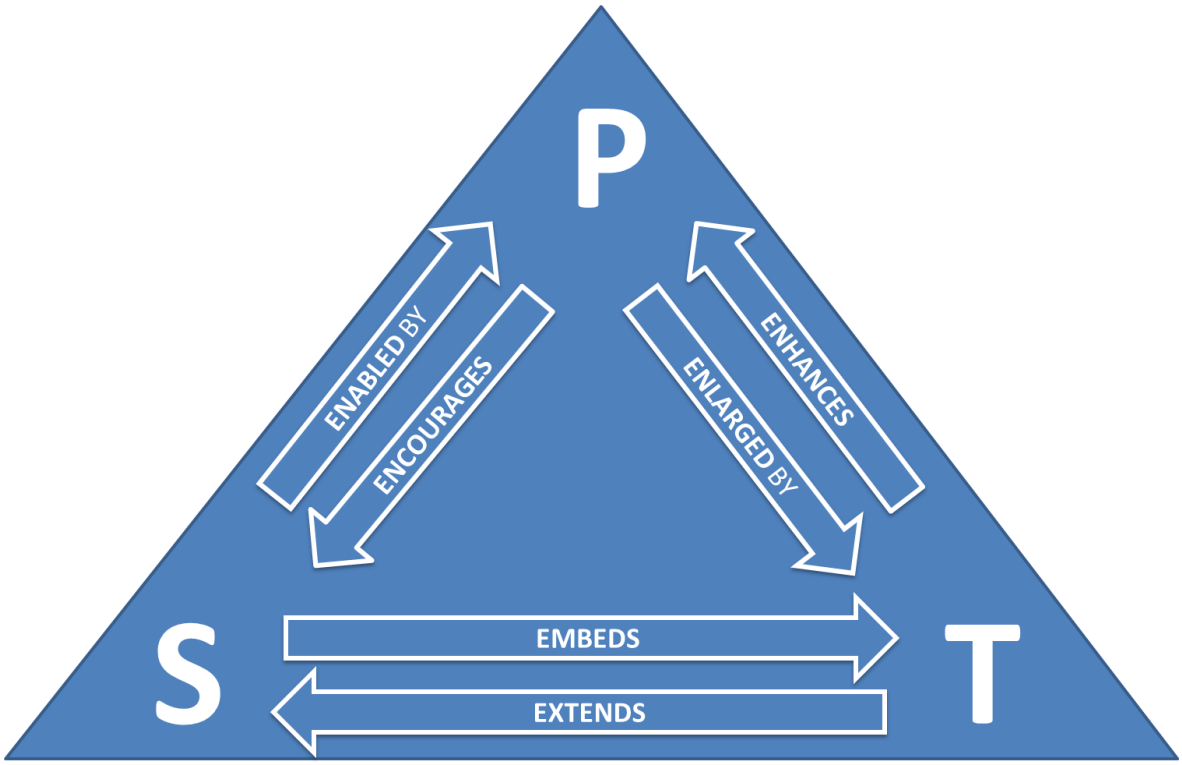


Fig. 5: The PST-framework illustrated

Here we find the first obstacle in the PST framework. During and after Covid, we transitioned from the familiar physical learning space to hybrid and online learning spaces.

New Ed. Tech solutions experienced considerable challenges in delivering and moving between various learning spaces[26]. Hence, the interaction and cyclical processes in the PST framework must be iterative processes that collect experiences and evaluations guiding the technological and pedagogical affordances that merge the continuum from physical over hybrid [26], [27] to a virtual learning space.

Below is an example of types of pedagogies and related activities in various spaces, under development by NTNU and TUDelft. Three different spaces or domains divide the horizontal axis. Teaching and learning happen over several domains, from onsite over hybrid to completely online practices. Each domain demands its affordances and equipment. Moreover, each domain prescribes the ways of work in one way or another, meaning pedagogies must stretch to the given situation and its possibilities/limitations.

- Frontal Pedagogy (FP) is the conventional and well-established teacher-oriented lecture with occasional questions or planned moments for interaction.
- Participatory Practice (PP) moves from the teacher-centered lecture to a more student-oriented practice. It is about mixed practices with interactive elements to gain participation by engaging and activating the students in collaborative work.
- Joint Problem Solving (JPS) practices aim at ill-structured situations or "wicked" problems.

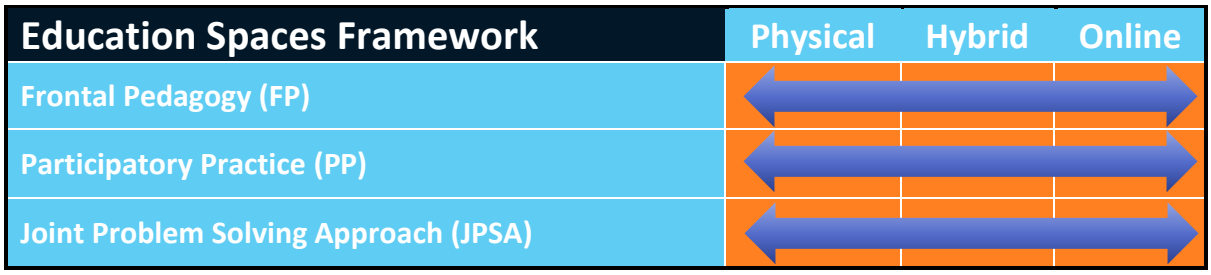


Figure 6. Education Spaces Framework

There are, however, many challenges concerning the pedagogical activities we used to do in a regular classroom and the mirroring of these activities directly into the hybrid and online learning spaces. Just mirroring what we do F2F into a hybrid or online environment does not work. We must adapt the pedagogy and technology to bring back co-presence [28], shared activities, and interaction as essential elements within future learning scenarios.

Part B: Elements to be considered when implementing a strategy for collaborative work, including Educational Technology.

Methodology

The elements considered in this part B of the pedagogical strategy consist of a three-step methodological approach.

1) Firstly, it contains a broad literature review in various and random search libraries.

The searches was based on the keywords “collaboration”, “communication”, “coordination”, “Educational Technology”, and “pedagogy”. Due to many potential hits, the search was revised to “collaboration + Educational Technology”. The findings from the literature were related to the data collected in IO1 in this project and then

2) discussed in the consortium.

The consortium includes researchers, teachers, programmers, AV experts and stakeholders. Fifteen elements were identified as most important when achieving increased learning outcomes from collaborative work. The elements were also considered vital when designing collaborative work in different learning environments; face-to-face, hybrid mood, and online environments. In order to provide a strategy and pedagogical approach for the instructor, it was essential to include more voices from these types of end-users.

3) Hence it included data collected from the instructor training activities. The data was collected through a three-part case based survey for Teachers (and some other participants) during the training.

- Part A was designed to get the participants in the right mood, asking for individual perceptions of the importance of 12 elements when doing collaborative work. In addition, the participants were asked to rate the importance on a Likert scale from 1-5, 5 being very important.

- Part B was directed toward the individual usage of Ed. Tech when lecturing. The participants was asked 12 questions to be answered with yes or no.

- Part C consisted of three allegations to be discussed among the participants concerning the central elements of running collaborative work with Ed.Tech. One participant collected notes from the discussion, and all the data was collected and submitted to the consortium for processing. Thus the instructor training activities have provided qualitative and quantitative data to be included in this part B of the strategy[1].

[1] For link to questionnaires and all results, contact the authors.

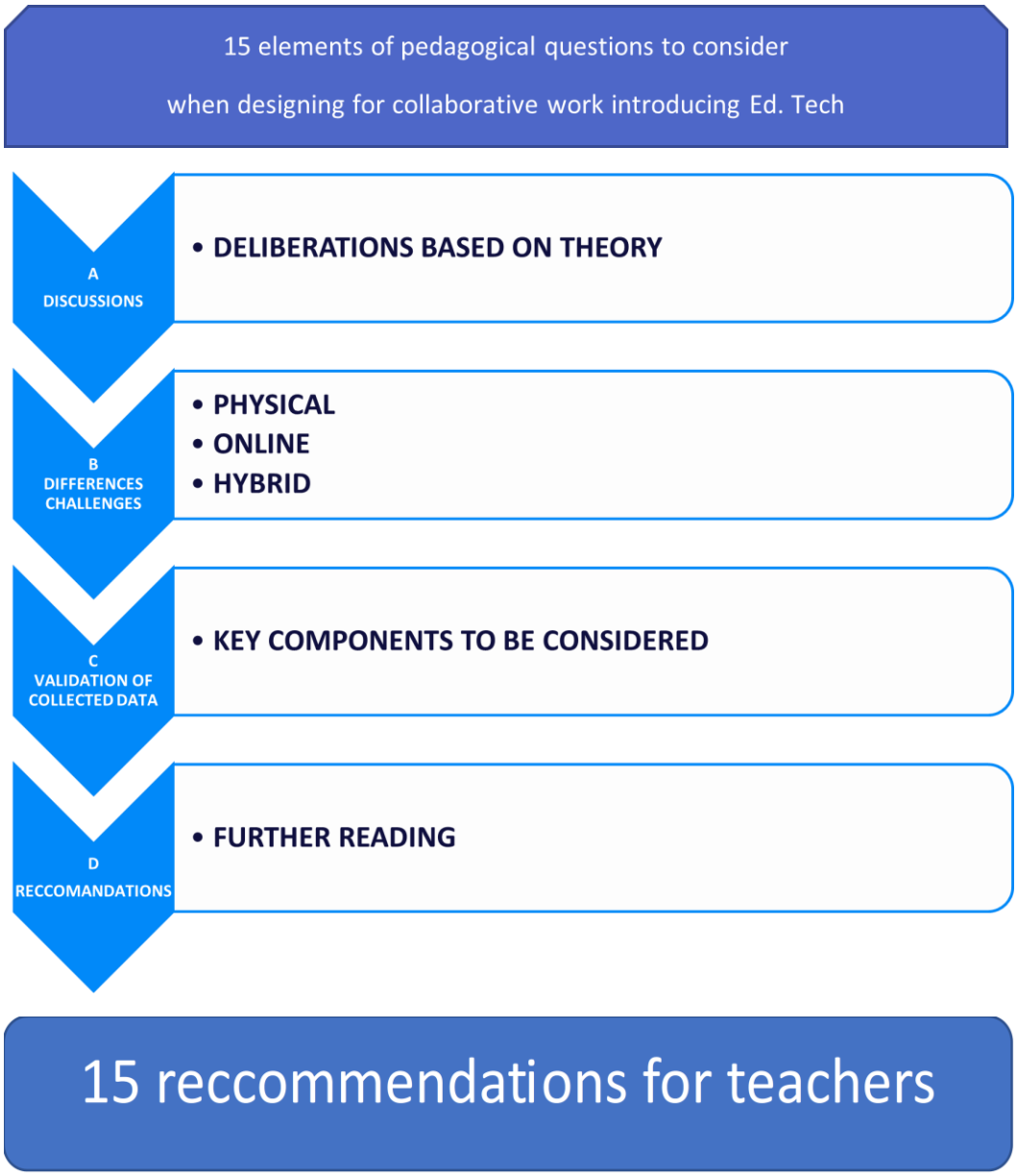
The following extracts of the work presented in this methodology divide into four paragraphs on each of the fifteen elements.

Paragraph A presents the deliberations and discussions based on theory.

Paragraph B focuses primarily on differences and challenges when doing online collaborative work, contrary to physical group work.

Paragraph C provides validation of the previous through data collected from instructor training. Mainly the strategy will use this data to underline interesting key components to be considered.

Paragraph D provides recommendations for further reading.



a) Every learning activity needs a clear learning objective; nothing is different considering collaborative work. According to the theory of collaborative work, group work allows for a higher or at least different learning experience than sitting alone working on cases. The group functions in various ways as a catalyst for learning and understanding how to learn (self-regulation). Mortimer and Scott hold communication as the critical element to meaning-making and individual construction of knowledge [29], which is also supported by others[30]. The collective meaning-making process allows all members to draw on their previous experience, participate, and add extra dimensions to academic achievement through discussions and practical work.

When considering the learning design, it is essential to remember and include the social component of the learning phase, which is unique for collaborative work. Therefore, it is recommended that the learning design allows for high performance due to the increased learning sphere achieved through more voices in work, as well as allowing for both time allocation (Time frame, Assessment and Communication) that recognizes the social aspect of the collaborative work.

b) The social aspect is the most complex and vital difference between a physical presence by all group members and online/hybrid solutions. Hence, considerations should focus on achieving the wanted social sphere in an online environment. First of all, providing the necessary tools for good communication, beyond only the video conference tools, and secondly, making an extra effort in the Instructions to encourage active participation from all group members in the collaboration.

c) The instructors participating in the training are very aware of the benefits of collaboration connected to social interaction and the importance of micro communication and body language when doing collaborative work. This awareness is stated by several of the instructors when discussing the allegation about the need for physical presence to do collaborative work. Physical presence is traditionally considered the most beneficial and must be included in any collaborative work's aims. In addition, the students should learn from each other, so the learning designs must aim for this.

In the case of introducing Educational Technology, the learning design needs to utilize strengths and benefits that go beyond the traditional f2f situation. Therefore, looking at the answers from the individual questionnaires in the instructor training is interesting to see how the learning design reflects this view.

When answering individual questions in the instructor training, the three first questions might be most interesting, considering what a good learning design should provide in a collaborative setting. The instructors agree that the division of tasks within the group (average score 4,37 of 5,0) and the possibility of interaction between the group members (4,76) is the most important when running collaboration activities. Less critical, it seems, is the roles allocated to group members (4,04, with a standard deviation of 0,83). Interestingly, as many as 21 out of 46 instructors do not allow their students to use social media to interact during the lecture. Consequently, the instructor has to facilitate physical interaction orally online or create a chat channel or shared screen opportunity to utilize the benefits of communication in the learning group.

d) Further reading on the topic [31], [32]

Conole, G. (2010). Learning design – Making practice explicit. In: ConnectEd 2010: 2nd Inter-national conference on Design Education, 28 June - 1 July 2010, Sydney, Australia

Wilson, K. J., Brickman, P., Brame, C. J. (2018). Group Work. CBE life sciences education 17(1):fe1. DOI: 10.1187/cbe.17-12-0258

Instructions

a) In what we call the pre-phase, i.e., the time before the collaborative work formally starts, it is essential to deliver clear and concise instructions to participants. We recommend that the students are obliged to participate since this information is mandatory.

Depending on the Time frame provided for the work, one could divide the instructions into different parts, whereas the instructor could provide individual instructions to participants in order to heighten their engagement.

However, individual instruction is not feasible if a) the time is short for the work or b) the Assessment includes grading of a final product. No matter what type of collaborative work the teacher initiates, it must allow as many students as possible to participate by motivating the students to "active learning" and helping each other, as well as providing Materials and opportunities for everybody to get involved (Communication). Here comes the importance of being thoughtful about how we design and apply the collaborative activities; they must be outlined to ensure that all students, even those who struggle, play an important and relevant role.

The instructor will need to inform students about Assessments and grades, but the most important thing is to be clear about how much time students have to complete their work. In case there are several tasks to undertake, it would be convenient if the instructor fixed some indicative times regarding how much time they should spend on each activity to ensure they do not lose track at the end.

Deadlines need to be defined but not too tight. If the students experience that they do not have enough time to perform the tasks at hand, this will restrict their creativity and ability to overachieve in the group, contrary to what collaborative work should be. Therefore, we recommend setting deadlines and indicating time spent on each of the sub-tasks for the participants. Hence, point the group in the right direction without micro-managing anything threatening creativity and motivation. Gaining time management skills and mental agility is vital for all participating, including the instructors. When giving instructions, it is also essential and helpful to put an example as a demonstration of how to do things.

Instructions must also account for the learning design and aims of the task, and of course, for the assessment. Concerning Assessment, the learners must be aware of the focus on progress, and, if wanted, the ability to use the tool and its inherited functionalities. As in every collaborative work, the instructor should be very clear on all aspects that lead to the achievement of the task, like time, materials provided, infrastructure, rules of conduct, and participation in the collaboration (see Communication).

b) Instructions provided are as important when doing collaborative work using online tools. Fundamental is the instructions provided for the tools themselves, which is time-consuming (see discussion on digital competencies earlier), but even more important is that the tool should provide extra opportunities and different learning methods than in "ordinary" collaborations. Hence, we recommend that the instructor allocates the time needed for learning the tool, either in front of the collaborative work or as a kick-off to the group allocation. We suggest doing a demonstration in plenary and then allowing the learners to investigate the tool's possibilities together in the selected group.

Especially for online groups: When ending a task, all groups might not be at the samplace/or done with the task. Allow for written/oral participation (include more students in active participation). Think about those external factors that could pose a problem to those students submitting their work online (i.e., technical problems) and provide them with an alternative or solution in case they cannot submit their activity on time (Technical competencies/digital skills).

Digital tools will probably allow for a higher number and more precise instructions that are easily accessible and always present. Hence, it will remove some stress from the precision of the oral explanation, but it also means that the written instructions must be more detailed and explained than in a physical setting. Therefore we recommend that the instructors spend additional time on the written instructions before collaborative work is done online or in a hybrid format.

c) When discussing cases and implementation of collaborative tools in a learning environment, one of the instructors was especially concerned about the training of the students in properly using the tool: "I have chosen not to use iLike (*a response tool, our remark*) when teaching this year, since I have used it for many years and I thought I should try without it, but I see that I lose a small amount of the knowledge of the student group, so maybe I had not been so surprised if I had used it more in lectures. So, the main benefit of iLike is the effective use of resources." The instructor thought the students would benefit more from the learning exercise if trained in using the tool before the upcoming learning activity. Another instructor involved in STEM subjects pointed out that mathematical language was difficult to find or implement in a digital tool, thus stressing that the instructor needs to want to use the tool if one should spend time teaching the students how to use it. Several instructors were also concerned about digital ethics and the need to instruct the students on GDPR rules before using Ed. Tech in collaborative work.

d) Further reading on the topic [22], [33]

Uduafemhe, M. E. (2021). *TEACHING TRADE SUBJECTS WITH LEARNER- CENTRED METHODS: A CASE FOR SCAFFOLDING AND COLLABORATIVE INSTRUCTIONAL APPROACHES TEACHING TRADE SUBJECTS WITH LEARNER-CENTRED METHODS: A CASE FOR SCAFFOLDING AND COLLABORATIVE INSTRUCTIONAL APPROACHES*. Ruemu-Max Technology Consult. ISBN: 978-978-991-614-6

Talmo, T. and Karlsen, H. R. (2021). EXPERIENCES ON USING DIFFERENT DIGITAL ENVIRONMENTS AND TOOLS FOR ENHANCING LEARNING EXPERIENCES. Published at INTED2021. DOI: 10.21125/inted.2021.0194

a) There are differences between subjects when considering the supplied materials. Still, in collaborative work, it is often recommended that learners go beyond the curriculum and utilize all the member's strengths, thus allowing for some practical work besides the theoretical parts. Therefore it is necessary to consider which materials are made accessible in the work. Firstly, one must decide if the materials should be theoretical or practical. If practical, one must consider price, effectiveness, availability, access for all considering a competitive element, and time needed to get the materials. On the other hand, theoretical materials might be easy to access through reference materials, project documentation decided by the instructor, or manuals for using digital tools. Secondly, one needs to decide if the instructor or the learners should be in charge of obtaining the materials and to what degree creativity and problems solving considering materials should be included in the Assessment.

   One must also consider how to deliver Materials, even their physical shape. Common is to do print-outs, which in 2023 might not be environmentally sustainable. Still, some documentation is helpful physically, while others can be distributed online or in another digital shape, like infographics[2]. Often in collaborative work, it is necessary to provide other materials, for example, when doing laboratory work, where availability, cost, and time limitations may cause challenges and careful planning.

b) It is a noticeable difference between online and physical collaborative work when considering materials. In a collaboration solemnly done online, physical materials are more or less removed, depending on the learning design and instructions delivered. On the other hand, the need for access to theoretical materials is even more critical. Hence, when doing online collaborative work

[2] For examples and on what an infographic is: https://venngage.com/blog/what-is-an-infographic/

(which is almost as important physically), we must provide easy access to information online and focus on critical thinking, rules of conduct, internet ethics, and clear instructions on source criticism (see Technical competencies /digital skills).

c) When discussing cases, the instructors explicitly identified the need for stringent and well-coordinated materials to be distributed to the students when doing collaborative work. Some instructors pointed this out as one of the strong points when introducing Ed. Tech. to the collaboration, the ability to share and discuss the content and the materials at hand digitally. With shared functionalities, it is easier to coordinate the work and maintain a monitoring view for the group members.

When we examine the individual answers from the instructor training on the importance of thinking together visually or orally, the instructors agree that this is essential (average score of 4,46 of 5,0), and even more important is the possibility to discuss content with peers when doing collaborative work (4,54). These statements indicate with certainty that these essentials for successful collaborative work must be reflected in Ed.Tech`s usage. In our instructor group, 36 of 46 actively use LMS or similar to upload curriculum, and as many as 42 can discuss content digitally with their students. At the moment, the instructor has started to implement Ed.Tech also in collaborative work, the instructor should use these possibilities all the time to enhance the student's awareness of the possibility and train them in using it themselves.

d) Further reading on the topic [34], [35]

Mark D. Gross,Ellen Yi-Luen Do,Raymond J. McCall,Wayne V. Citrin,Paul Hamill,Adrienne Warmack,Kyle S. Kuczun (1998): Collaboration and coordination in architectural design: approaches to computer mediated team work. *Automation in Construction, pp. 465-473*. Elsevier

Jamaiah H. Yahaya1 , Maslina Mohd Basir2 and Aziz Deraman (2015): Unified Communication and Collaboration Model for Virtual Distributed Team Work: A Study in Malaysia. *International Journal of Software Engineering and Its Applications Vol. 9, No. 2*, pp. 125-142. http://dx.doi.org/10.14257/ijseia.2015.9.2.11

Cases – structure

a) A vital part of every collaborative work is the cases provided for the learners. To some extent, the cases provided, or simple questions of question-based pedagogy, is the skeleton of the learning design. Thus, critically considering aspects of the case presented to the learners is crucial.

Success factors in collaborative work involving Ed. Tech consists of active participation (see Pedagogy), inquiry-based learning, and the possibility to monitor and Assess the progress and the end result. However, these factors put high pressure on the structure of the cases. When designing a learning case, the instructor needs to focus on the academic Aim of the work. A precise aim gives participants a learning path to agree upon and access. In many ways, the aim of a case should be like a research aim and divide the collaborative work into smaller research objectives [36]. These objectives structure time, progression, and self-regulation for both the instructor and the students and allow for dividing the work into part-products or smaller and individual tasks.

Additionally, the case needs to be designed to open for different or alternative solutions to allow for extended learning compared to individual tasks to utilize further what Vygotsky calls the zone of proximal development [37] by using the social setting in collaboration and the peers inherit knowledge.

The cases must also provide the required background information to ensure that the initial idea phase in the groups does not take too much of the allocated time. The case also needs to include an accessible, low-scale entrance considering taxonomy and allow the high performers to be challenged. It is recommended that the instructor focuses especially on being precise in the aim of the task and also pay extra attention to the wording of the case background.

b) The main difference between online and f2f environments regarding the structure of the cases is the reduced opportunity for Facilitation in online environments leading to extra stress on the written Instructions and the clarity in case structure. To amend the difficulties of being unable to guide and facilitate the collaborative work, we suggest it might be wise to include minor meeting points in plenary or plan for group meetings throughout the time allocated for the task (see bullet point 6).

The instructor needs to be aware of the reduced attention span reduction in online working environments.[38] Hence, the dedicated time for each part-task should take into consideration the reduction of participants' ability to focus when discussing online.

c) When discussing cases and allegations, the instructors are not too concerned about the case structure but more about the case content (see Learning design and aims). Some instructors mention that it is necessary to balance the activities when using Ed. Tech in collaborative work. These comments are, of course, connected to the shortened digital attention span, the division of tasks, and the lack of micro-communication. Therefore, the cases need to cater to collaboration and individual work, as well as introduce social communication between the work.
Looking at the individual answers, it is evident that the instructors find some opportunities more interesting than others when starting to use Ed. Tech in collaborative work. It is fascinating to see the emphasis on coordinative functionalities. When answering on the importance of division of tasks, the mean score is 4,37, and when answering on which tools they are using, 36/46 state to use LMSs. It is also commented on in the discussions that tools allow for better coordination and can be helpful when designing collaborative work using Ed. Tech.

d) Further reading on the topic: [39], [40]

William Littlewood, The task-based approach: some questions and suggestions, *ELT Journal*, Volume 58, Issue 4, October 2004, Pages 319–326, https://doi.org/10.1093/elt/58.4.319

Kim, S., Phillips, W.R., Pinsky, L., Brock, D., Phillips, K., Keary, J. (2006): A conceptual framework for developing teaching cases: a review and synthesis of the literature across disciplines. *Medical education, pp. 867-876*. DOI: https://doi.org/10.1111/j.1365-2929.2006.02544.x

a) According to several studies, such as Kagan[41], the standard group size recommended for collaborative work is between 4 to 5 participants, as a tendency demonstrates that performance decreases when group size increases[42]. The ideal scenario is that groups are arranged by the teacher, who shall consider students' skills, abilities, and capacities when deciding group allocation to guarantee that all groups are, more or less, fairly distributed.

Notwithstanding, we must consider that the perfect group size will depend on various factors, including the subject in question and the type of classroom setting. For example, a study undertaken in 2012 by Apedoe[43], demonstrated that chemistry students in a mainstream classroom worked better in groups of 3-4, while chemistry students in an advanced classroom worked better in pairs. In addition to the latter factors, the possibility of losing students throughout the working period may lead to the need to reallocate students into groups and redistribute roles. This issue might be a bigger problem at higher education institutions than in VET, Adult learning, and high school, where participation is not compulsory.

b) The group size should be different when considering the difference between online and face-to-face (f2f) learning environments. For example, when doing online collaborative work, the lack of communication might be the biggest problem, a problem that accentuates in those cases where there are many participants, and the intervention or lack of intervention of one of them might not be essential. The latter is supported by a study demonstrating that larger groups might cause the isolation of some students and the creation of smaller subgroups.

The latter factors lead us to opt for smaller groups online than f2f to ensure a safe environment that encourages all learners to participate actively. Here, the instructors have a crucial role in guaranteeing that collaborative work attains the learning goals expected as they must provide adequate means of communication, both online and offline, by adapting them to groups' necessities and keeping track of the tasks done by students (mainly in the online environment) (see Facilitation).

c) When discussing cases and allegations during instructor training, it seemed as if there were especially one concern mentioned and discussed amongst the instructors: It is easier to stay inactive and passive in discussions when doing online collaborative work. The qualitative data also shows some concern about students staying inactive and passive in discussions, especially when doing an online collaboration, indicating that there is a need for smaller groups when introducing Ed. Tech in collaborative work. These discussions can also shed some light on the results from the individual parts. In part A, they were asked about the importance of micro-communication (i.e., use mimic, sighs, smiles), and the average score was the lowest we found (3,78). Accordingly, the scores indicating uncertainty (4,28) and turn-taking (4,35) are not impressively high. These are elements that come more naturally when doing more traditional collaborative work. These elements can also shed some light on the results from the individual part, the low scores considering communication, and the high average scores considering coordinative elements.

In collaboration, the ability to coordinate might reduce the need for communication throughout the whole time scale allocated. Thus, we recommend dividing tasks more to increase efficiency.

d) Further reading on the topic:[44], [45]

Saqr, M., Nouri, J., Jormanainen, I. (2019). A Learning Analytics Study of the Effect of Group Size on Social Dynamics and Performance in Online Collaborative Learning. In: Scheffel, M., Broisin, J., Pammer-Schindler, V., Ioannou, A., Schneider, J. (eds) Transforming Learning with Meaningful Technologies. EC-TEL 2019. Lecture Notes in Computer Science(), vol 11722. Springer, Cham. https://doi.org/10.1007/978-3-030-29736-7_35

Jan G.M. Kooloos, Tim Klaassen, Mayke Vereijken, Sascha Van Kuppeveld, Sanneke Bolhuis & Marc Vorstenbosch (2011) Collaborative group work: Effects of group size and assignment structure on learning gain, student satisfaction and perceived participation, Medical Teacher, 33:12, 983-988, DOI: 10.3109/0142159X.2011.588733

Time frame

a) It is difficult to provide recommendations for scaling a project in time simply because it is dependent on the aim of the Learning activity, the Instructions, and the structure of the case(s). However, no matter the subject, level, and mood of delivery, two things must be considered when designing the scheduled time: The time needed to explain the benefits of working collaboratively and the time needed to learn essential functionalities in the tool, based on an assessment of the digital skills inherent in the group.

The instructor needs to explain and give reasons for why the work task needs to be done collaboratively. If the learners do not see the benefits of collaboration concerning this work task, it will surely end up with cooperation instead of collaboration. If this is with intention, one can spend less time on reasoning. Given that the tools introduced for collaboration are new to the student group, the instructor must allocate enough time for the learners to get familiar with and train with the tools, allowing for better internal communication and coordination of the work in the student group. If the tools are known, the instructor should still spend time explaining how the students should learn more from using the tools actively. The real advantage of using digital tools considering time is efficiency. Once the learners master the features of the digital tools, it will allow for quicker storage, communication, and collaboration compared to manual tools. Hence, the instructor can design for both short and long periods of collaborative work. For example, the collaboration can use a response tool between 3 minutes and a day, depending on the functionality included.

b) We already know that the attention span of learners is less when doing online training and impacts how to design for online collaborative work. It is necessary to provide enough time to deliberate and discuss but not force the learner to be stuck in front of the screen for too long. It is also easier to drift away when being online. There are many distractions, so there will be less efficient group work.

c) When discussing cases and allegations in the instructor training, there were no questions directly aimed at the time frame of the work. Still, instructors were interested in discussing this in full via other matters, showing the importance of setting the correct time frame. Apart from the discussions on how much time was needed to train the participants to use the tools, the instructors discussed the effectiveness of digital functionality, allowing for faster coordination and communication. On the other hand, instructors also pointed out that online teaching demands more time than f2f-lectures, thus providing an argument for allocating more time for collaborative work with Ed. Tech. It seems to come down to the participants' experience using the tools. When asked individually about their experience and training of students in digital tools, we can see that instructors use digital tools extensively between colleagues (for example, 41/46 use chat functions

to cooperate with colleagues) but more occasionally with the students (28/46 use GIFs/animations, 25/46 allow students to use social media). These figures indicate that the students lack the training to use digital tools in a learning environment. Therefore, training will require more time before using tools and functionalities efficiently. Therefore, we recommend introducing and using digital tools throughout the academic year to enhance the effects of Ed. Tech also in collaborative work.

d) Further reading on the topic: [46], [47]

Sandeep TK (2016). A study at the digital gadget addiction of youth in south India. *Online International Interdisciplinary Research Journal*, {Bi-Monthly}, ISSN 2249-9598, Volume-VI, Sept 2016 Special Issue

M.B. Tinzmann, B.F. Jones, T.F. Fennimore, J. Bakker, C. Fine, and J. Pierce, NCREL, Oak Brook, 1990, 'What is the collaborative classroom?'

Instructor role

a) As in any other learning situation, the instructor's role is fundamental in collaborative settings. However, some instructor duties need extra consideration when discussing collaborative work. Here are the primary duties:

Firstly, the instructor needs to be participative during all phases of work, not solemnly the pre-phase and Assessment. In addition to this, while students are developing their assigned tasks, the instructor needs to be on-site, available for discussions and questions, and initiate new topics and discussions amongst the group members. The latter means that the instructor should actively participate by introducing new areas to be investigated and new topics of interest that students can research themselves and formulate the curricular elements. A study undertaken by the University of Tampere, Finland [48] supports the abovementioned arguments as it discovered that students acquired intense learning experiences when they were encouraged to reflect on different issues that the teacher had raised in her comments.

Secondly, the instructor is always vital in the pre-phase, dividing groups and setting the framework for collaboration (see bullet points 2-4) and the learning design (see bullet point 1). Finally, instructors are in charge of establishing classrooms with diverse and flexible social structures that promote appropriate behavior for communication and collaboration among students (see bullet point 13). These structures are rules and standards of behaviors, fulfilling several functions in group interaction and influencing group attitudes. Particular rules depend, of course, on the classroom context. Thus, teachers often develop them collaboratively with students and review or change them as needed. Examples of rules are allowing all members to participate, valuing others' comments, and arguing against (or for) ideas rather than people.

When it comes to assessment, the instructor's role is essential given that they must be firm evaluators to Assess both the process and the summative results including the ability to provide concrete and constructive feedback.

Considering the instructor's role, the biggest question is still during the allocated work time and connects to the difference between Facilitation and participation and/or initiation. Participation/initiation means that the instructor takes an active part in the discussion, delivering what the group members might consider more factual than what they would be able to figure out. On the other hand, facilitating includes more of an oversight, where the instructor's role connects to the discussion's preparation. Of course, one needs to consider the participants' level, but still, considering the Pedagogy central to the collaborative work, we would recommend being a facilitator more than an initiator. Anyhow the instructor needs to monitor the work, i.e., overseeing that the whole process is OK, which is essential both for the learning and the assessment.

b) Some difficulties need to be mitigated when facilitating online collaborative work. The most obvious one is the lack of physical presence. Being in the same physical environment allows the instructor to observe students' engagement and micro-communication within the group. As long as the Learning design and summative Assessment include processual elements like the ones mentioned, it is recommended that these elements are covered by including an extra facilitator in an online environment. The extra instructor can then answer questions, seek out groups that need extra attention, and monitor the progress, while the instructor enhances discussions and brings curricular elements to the collaboration.

Similarly, the hybrid mode poses another challenge. It is easy to forget those connected online participants when working online and offline(f2f) simultaneously. One way to mitigate this is to design different teaching methodologies, one for each. Of course, these extra preparations will demand some extra time for the instructor, but if the design is feasible and all students gain results, it will mean that the extra time spent in designing two teaching methodologies will be saved in not having to explain the same theory twice.

Notwithstanding, we must say that online learning has a significant advantage over f2f learning regarding the relationship between instructor-student given that those students might be more willing to have direct contact with their instructor than if they were f2f in a physical environment. For example, in a lecture hall or classroom, it might be more complicated to get in direct contact with the instructor (as he might be moving around in the physical room), but in an online or hybrid mode, the instructor will preferably see every time a student raises their hand or asks a question in the chat for example.

c) The instructors are not too concerned about the instructor's role but instead focus on discussing the instructions provided. This approach is interesting, underlining the importance of a good pre-phase and structure of collaborative work. Still, some instructors point out that giving effective and instant feedback to the participants in the collaboration is essential to help clarify any doubts or uncertainties and make the work more dynamic. The above statements have weight when implementing digital tools. Therefore, one needs to provide a solution that fosters this type of feedback during the time allocated for the work.

d) Further reading on the topic: [48], [49]

Zanjani, N., Edwards, S. L., Nykvist, S., Gev, S. (2016). LMS Acceptance: The Instructor Role. The Asia-Pacific Education Researcher 25(4). DOI: 10.1007/s40299-016-0277-2

Sormunen, Eero & Alamettälä, Tuulikki & Heinström, Jannica. (2013). The Teacher's Role as Facilitator of Collaborative Learning in Information Literacy Assignments. Communications in Computer and Information Science. 397. 10.1007/978-3-319-03919-0_67.

a) The instructor's role is essential in every collaboration between peers. However, the facilitator's role in collaborative work is vital considering the assessment. A facilitator should be considered differently than an instructor in that he/she works with the group in a way that does not influence the group's decisions. Practically this means that a facilitator should be as neutral as possible when it comes to implementing and transferring knowledge, theory and other influential matters in the collaboration. The possibility of taking a role as a neutral facilitator has been contested in literature[50], but is still an objective aim for this role. Considering the neutrality of the facilitator, it is also possible to allocate this role to one of the group members themselves (see Learner roles), but we would not recommend it due to the task necessary to facilitate collaborative work, including Ed. Tech.

It is essential that the facilitator is not only seen as an advanced secretary, providing instructions, aid, and materials but takes an active role in ensuring progress and curricular and/or theoretical discussions during the collaborative work. Hopefully, this will enhance the learning effect of the chosen pedagogical approach. Thus, considering the collaborative work, the facilitator needs to divide his/her attention towards the progress, ensuring participation and ensuring that the group can achieve the aims defined in the learning design.

If one introduces formative Assessment in group work, it implies that the facilitator needs to be active, provide the necessary information, and guide the students toward the information that will enhance learning. During the work, the instructor needs to monitor the progress and ensure that all groups are moving towards the aim of the task without interfering in the creative process. The facilitator should always aid when asked but not initiate or direct the group in a different direction than they have decided. The facilitator needs to be more active in the post-phase of the work to ensure achieving the Learning outcome and correctly assess the collaborative work.

b) In online and hybrid environments, it is more difficult to monitor activity and act on students drifting or not participating. To achieve the highest performance possible several measures might be applicable. The facilitator can mitigate this by demanding that the participants turn on their cameras during the whole time-frame of the work, and also needs to be active in the chat rooms to enhance Communication amongst the students). In a hybrid learning environment, it is vital that the facilitator keeps track of the time and informs the participants in all locations about progression and content in different parts of the time scale, for example, to run short plenary sessions to explain theoretical issues brought up by several groups.

c) There are few discussions about facilitating collaborative work during the instructor training sessions. Nevertheless, looking at the results from the individual questions, we can find some fascinating insight into the usage of Ed. Tech among the instructors. Part B focus on practices with Ed. Tech, and it seems as if the ability to use functions for facilitation is scarcely introduced in the instructor role. Several questions concern how the instructor utilizes functionalities like shared screen, chat functions, raise the hand, and digital discussions, allowing the instructor to facilitate progress, dynamics, and cooperation to a great extent. The instructor, on average, rarely uses these functions. It might be something to reflect upon to achieve even better results by introducing Ed. Tech. Facilitating functionalities are available and maybe even easier to introduce and use when applying Ed. Tech than in ordinary f2f-situations. In the discussions, it seems that one of the problems is related to digital competencies among the instructors, making them uncertain about how to use these functionalities effectively. It is also related to the time available/invested in planning, implementing, and practicing using a digital tool for a particular purpose. For example, learning to use mathematical languages in digital tools might not be worth it. These issues can be more manageable if one regularly uses tools and various functionalities throughout the academic year.

d) Further reading on the topic: [51], [52]

Schwarz, R. (2005). Using facilitative skills in different roles. In R. Schwarz & A. Davidson(Eds.), The skilled facilitator fieldbook: Tips, tools, and tested methods for consultants, facilitators, managers, trainers, and coaches (pp. 27-32). San Francisco: Jossey-Bass

Hunter, D. (2007). The art of facilitation: The essentials for leading great meetings and creating group synergy. Auckland: Random House

a) Communication is the central part of any collaborative work. According to Lev Vygotsky, not even the mind can be understood if isolated from other effects, people, and cultural applications in the contextual surroundings, even less the learning experience [53]. Therefore, when doing collaborative work, it is necessary to consider how to make the most of the communication between peers to enhance the learning effect beyond what the participants could have learned individually.

There are several consideration points when it comes to communication. The starting point should always be the instructor's part in the communication. The instructor needs to set rules for communication to some degree. Depending on the Aim of the work the instructor can decide on detailed rules or leave it to the group themselves. Nevertheless, there should be rules for talking time internally in the group, how to signal for voicing your opinion, decision making, and hospitality in the discussions.

Another important aspect is the coordination of the internal workload and how to communicate on tasks being done and finalized. This coordination is essential to remember to maximize the effects of the Time given for the work. In addition, archive functions or common storage areas that are accessible to all participants are necessary in order to make the communication work, and the Materials should be categorized and defined in a way that allows all to communicate about the same part-product all the time.

b) Turn-taking and decisive rules for communication might be even more critical when collaborating on a task in an online or hybrid learning space. It is also apparent that the Instructor needs to instruct the students on ways of communicating in online and hybrid environments, even training the participants in online/hybrid technical issues, behavior, and netiquette before the work begins. An online environment has features and additional possibilities, like the opportunity to talk, chat and share files and other media. These features enhance propinquity, which can be explained as a feeling of nearness when using different communication channels in the collaborative work, which is essential when including Ed. Tech. in collaborative work. The TEP theory was designed before the internet and introduced as “a general theory of mediated communication”[54], and has become even more relevant after the internet's introduction and disruption of the learning environments.

Enhancing the effects of communication in online and hybrid environments depends on maintaining a platform where participants are allowed to utilize different types of communication, like oral and written communication. Furthermore, the instructor should always be granted access to all communication channels to facilitate the discussion and progress (see bullet point 8). This

access is complicated in online environments when the instructor is not in the same physical learning space as the learners. Finally, there might be even more critical in these environments to design the Roles in the group, especially a leader in each group, in order to aid the instructor in the facilitation, keeping the Time frame and ensuring progress instead of endless discussions inside the group.

c) When discussing cases and allegations, the instructors are highly focused on communication in the group, especially when introducing Ed. Tech to the collaboration.

When looking at the individual answers, the four highest average scores are from the importance of communication in collaborative work (The possibility of interaction, the ability to comment on ideas, the possibility to think together, and the possibility of discussing content). This fact shows that communication is essential for achieving the desired learning outcome. Therefore, it is surprising that few of the same lecturers allow students to use social media to cooperate and interact during lectures (25/46). SoMe introduce an easy way to communicate, less ambitious than many other digital functionalities, less stressful for many students than oral discussions, and should be considered for communicative purposes in a collaborative work introducing Ed. Tech.

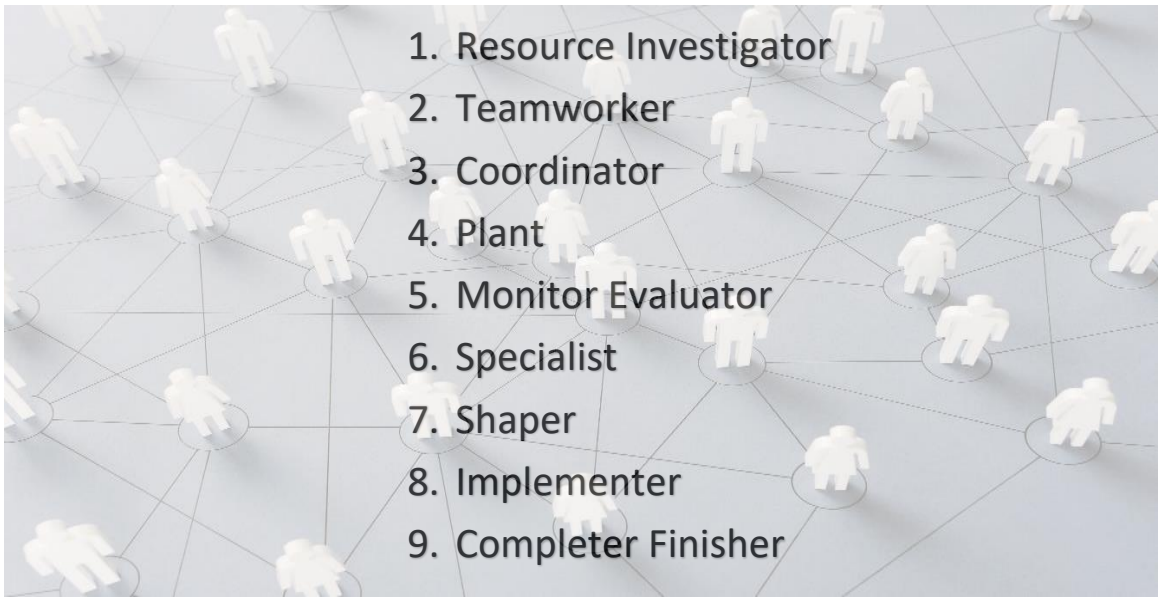
When discussing the allegations, the instructors are aware of the lack of micro-communication and body language when doing digital lectures. At the same time, they claim that often the discussions are better, more free in terms of exchanging ideas and experiences when the camera is off. Some claim that digital tools improve students' ability to communicate and collaborate and that students are more willing to defend their arguments via a more anonymous setting in a digital framework. These claims should be reflected upon when designing rules and guidelines for internal discussions and starting collaborative work. Furthermore, the tools implemented need to be adapted for the purpose and that participants must be trained in digital etiquette and manners to make the communication work.

d) Further reading on the topic: [11], [55]

Traxler, J. (2010). The 'learner experience' of mobiles, mobility and connectedness. In Background paper to presentation ELESIG Symposium: Digital Futures. UK: University of Reading. Retrieved December 12, 2013, from http://cloudworks.ac.uk/cloud/view/3472

Walther, J. B., & Bazarova, N. N. (2008). Validation and Application of Electronic Propinquity Theory to Computer-Mediated Communication in Groups. Communication Research, 35(5), 622–645. https://doi.org/10.1177/0093650208321783

a) There are thousands of theories on group allocation and team roles, meaning that one needs to decide on one that best achieves the group work aims. We recommend one of the most advanced and appreciated theories: Belbins nine team roles [56]. Clearly, people are different, and we act differently in various situations. In collaborative work, it is more evident than usual that we take on different roles in relation to others. Belbin's theory build on different questions like who we are when relating to others, how we can utilize each other strengths, how people approach problems, and how we can avoid tensions. According to this theory, nine different roles are useful in collaborative work.



When designing a learning experience through collaborative work, it is necessary to deliberate on forming the group and ensure that all roles are covered in two or more participating learners. For example, when utilizing digital tools, divide into groups that involve at least one resource investigator (in order to investigate all opportunities), a team worker (to secure social relations and equal participation), a monitoring evaluator (to ensure good quality and best solutions at every stage of the task) and a completer finisher (to make sure that the collaboration finds its end aim). Moreover, even more important: each group needs a leader that can oversee all aspects of the work. The instructor should appoint the leader.

b) It is not easy to see that special considerations need to be taken when doing online work instead of a physical setting considering learner roles. However, there is still the question of active participation when attending online. A discussion is ongoing considering camera-off/on when participating in an online session [56]**.** Furthermore, it is crucial to make an effort to include team workers in all groups, even if their camera is off, by giving them additional responsibility concerning social inclusion.

c) The instructors are not aligned when asked how important the roles allocated to group members are in collaboration. The average score is 4,04, i.e., not too high, but the standard deviation is as high as 0,83, meaning that the instructors vary significantly in their answers. This finding is fascinating, as the instructors have varied experience with f2f and online training.

There are several discussions revolving around the learner roles in the instructor training without necessarily connecting them directly to specific roles. The main thing to focus on seems to be the more flat structure in a digital environment where participants seem more engaged in the process and able to utter their opinions. Secondly, several instructors independently state that digital tools allow for more cooperation and coordination without specifying how. When designing collaborative work with Ed. Tech one should at least consider the roles less critical than in a physical environment and instead put extra focus on coordinative abilities in the group.

d) Further reading on the topic [57], [58]

Saha, M. (2019): Perceptions about Learners' Roles and Functions in Online Higher Education: A Qualitative Research Required. *Journal of Teaching and Teacher Education* 7(01). DOI: 10.12785/jtte/070101

Ngar-Fun Liu, William Littlewood (1997): Why do many students appear reluctant to participate in classroom learning discourse?. System, Vol 25/3, pp. 371-384. ISSN 0346-251X. https://doi.org/10.1016/S0346-251X(97)00029-8.

"THE TYPES OF BEHAVIOUR IN WHICH PEOPLE ENGAGE ARE INFINITE. BUT THE RANGE OF USEFUL BEHAVIOURS, WHICH MAKE AN EFFECTIVE CONTRIBUTION TO TEAM PERFORMANCE, IS FINITE. THESE BEHAVIOURS ARE GROUPED INTO A SET NUMBER OF RELATED CLUSTERS, TO WHICH THE TERM 'TEAM ROLE' IS APPLIED."

MEREDITH BELBIN | TEAM ROLES AT WORK

a) Learning environments need pedagogical approaches in order to be efficient. Many, many didactic factors and aspects act as elements in the process of designing a fully functional collaborative learning environment. At the center of everything is the idea of active learning. The shift in approaches from a teacher-centered to a student-centered learning environment roots back to constructivist learning theories and even formal pedagogies developed by Vygotsky but has been elaborated even more through the introduction of educational technologies in the classroom. Einum (2019) investigates this shift in his doctoral thesis, where he applies iLike, a response tool designed for language learning, in modern classrooms and sees how the implementation dramatically changes the environment[59]. Active learning includes taking into account students' ability to learn from their peers. By being actively involved in the learning process, students not only learn in a different way than solemnly passively taking notes while listening, but they are also enabled to think about their own learning process, thus being enabled to self-regulate their learning process[18].

When implementing pedagogical approaches in the learning environment allowing collaboration via the use of Ed. Tech, it is vital to consider the Cases provided to the students. The cases need to include an element that requires collaboration, communication, and coordination between the members. Moreover, it should not only allow for it but make it necessary to reach a high score on the summative Assessment. Additionally, the cases should promote collaboration and individual work opportunities, especially considering the opportunities provided through new technological features. Finally, the students need to be challenged in their thinking and metacognition to learn MORE from this type of work then more conservative lectures. We, therefore, recommend Cases and group work designed with an end aim “only” achievable through collaboration, but sub-tasks included that might be done individually throughout the time scale for the project.

b) Given that we have already introduced Ed. Tech as an innovation in pedagogical approaches in collaborative work, it is interesting to look at the opportunities provided through what is known as flipped classrooms. In principle, flipped classroom means that instead of getting an initial lecture from the instructor before working with the content, students are introduced to the subjects before attending the lecture, for example, via small learning videos. Then the classroom time is spent working practically with the subjects/cases under the supervision and with the aid of the instructor. In their review of recent literature, Uzunboylu and Karagozlu [60] show how the flipped classroom, with its implementations of Ed. Tech also changes the roles of the instructor and the participants, allowing for new and maybe even improved ways of introducing curricular elements. Flipping the classroom will also emphasize the inherited knowledge already in the group, enhancing the probability of peer learning and making collaboration the most fundamental pedagogical approach in the learning environment.

c) Instructors discuss pedagogy in every aspect of collaborative work, as expected and needed. They comment on coordination, peer learning, and heightened digital and cooperative skills. However, there are predominantly two things that are mentioned often, which also can help improve the pedagogical approach for new teachers.

One instructor claims when discussing the third allegation: ”Videoconferencing is the online environment that best resembles physical presence. Thus, it is the only way to solve a problem when collaborating online.” Conversely, one instructor claims that “video conferencing is only a worse replica of physical presence”. These statements remind us of that introducing Ed. Tech needs a pedagogical purpose; a replica will never be as good as the original. The primary pedagogical approach that Ed. Tech aids, according to the discussions, are “interactivity”, including simple functionality like emojis, raised hand, shared screen, digital post-its, and more, but it also provides the opportunity of making the plenary parts or lectures more engaging. For example, one could introduce GIFs or animations to a PP to enliven it. When answering individually on the question of instructors use these sorts of elements, it is almost 50-50, showing that this is something that is considered interesting, but not introduced and used to its fullest yet. On the other hand, almost all instructors (41/46) use digital tools to communicate with students and elaborate on pedagogical approaches.

d) Further reading on the topic: [61], [22]

Lage, M. J., Platt, G. J. and Tereglia, M. (2000). Inverting the Classroom: A gateway to Creating an Inclusive Learning Environment. Journal of Economic Education, vol 31, No. 1, pp. 30-43.

Talmo, T., Sivertsen-Korpås, G., Mellingsæter, M. and Einum, E. (2012). **Experiences with Use of New Digital Learning Environments to Increase Academic and Social Competence**, proceedings from the 5th International Conference of Education, Research and Innovation (iCERi2012), 19.-21.11.2012, Madrid Spania

a) Assessment is always an ongoing discussion, maybe, even more, when doing collaborative work than individual assignments. There are two main ways of assessing students' work; 1) Summative and 2) formative assessment.

The summative assessment aims at grading and/or quantifying the final product(s) from the involved student(s), while formative assessment allows the students to improve their work continually and assesses more of the process and the final product. There are discussions on what to include when talking about formative assessment. For example, it might focus on discovering what students are struggling with, and it may be a way for the teacher to design their teaching according to troublesome areas; it may quantify engagement and participation in a task, or the formative assessment can enhance the student's ability to self-regulate through deciding which of their products might be improved. Bjørkli and Arnesen (2015) apply the view that the assessment is purely used to diagnose the student group and their inherited knowledge to provide immediate feedback to the students[62]. This approach may also be a sensible way of applying assessment in collaborative work involving Ed. Tech.

One also needs to consider what to assess. The most obvious question is the difference between an individual assessment of each group member and an assessment of the group as a whole. It is clear that in a summative approach, an individual assessment will reduce some of the processual effects of the collaboration and remove some of the exciting elements that differentiate collaborative assignments from purely individual work. Hence, this approach would be counterproductive. A better way to allow individual progress would be to let students self-assess. This activity is also possible for the group as a whole, but self-assessment could be directed directly

towards aims set for the Time allocated for the work, allowing the instructor to gain insight into the work being done by the individual, it would also aid the main idea in formative assessment theory, and allow the instructor to design the continued course/curriculum in a better way. Also, self-assessment aids students' self-regulation of the Learning process.

No matter the structure of the assessment, it is essential to allow all group results to be discussed in plenary/presented for the rest of the groups. This activity forces peer learning in the whole group, and the instructor should also include active participation in the OTHER group results in the assessment. The participants need to reflect on their work and compare their results and process to others doing similar or the same tasks. Online environments provide more automated and faster feedback and facilitate formative assessment and a final grading based on processes.

b) Online learning makes it easier for the examining body to manage all exam creation tasks. For the first time in over a decade, authoring questions can be done collaboratively, with transparent workflows to review and approve questions before they are loaded into the question bank. This process allows the instructor to add new knowledge and to ensure they give students high-quality ability tests to help each learner.

c) We asked the instructors if they used an educational tool that allows them to monitor the student's progress during a lecture—considering the clear recommendation in this strategy on assessing progress and utilizing mainly formative assessment, focusing on the fact that monitoring is even more critical but also a main advantage when doing collaborative work using Ed. Tech. Hence, surprisingly, only 26/46 of the instructors use a digital functionality like this. When looking behind the numbers, this result might be because some instructors say that tools sometimes feel like a gadget more than a pedagogical advance. These statements are essential to keep in mind. One needs to use the tools as comprehensive monitoring, not just as something new and "cool". Sometimes the tools might even feel ineffective, but if it provides an opportunity for monitoring and assessing THROUGHOUT the work, it provides additional value to the work.

d) Further reading on the topic [63], [64]

Bennett, R. E. (2011). Formative assessment: A critical review. Assessment in Education Principles Policy and Practice. DOI: 10.1080/0969594X.2010.513678

Test Reach, The Benefits of Online Assessment https://www.testreach.com/benefits-of-online-assessment-testreach.html

Room structure

a) When designing a room structure for collaborative work, there are several things one needs to consider. First, depending on the size of the groups, one needs to consider where and how to place the groups. The location depends on the infrastructure available at the institution, but preferably the groups should be in one room to make it easier to Facilitate the discussions. Usually, the instructor's resources will be limited, meaning it is difficult to see all groups if placed physically apart. When placing the members, it is important to arrange furniture and common focal points so that the members benefit from the micro-communication and part-taking in the discussion. If possible, a round table structure will enhance the positive collaborative effects in the best way. If impossible, the instructor needs to decide what is most important.

1) the ability for members to interact with each other and the teacher (community),
2) the teacher's ability to monitor and assess (activities done), or
3) the member's ability to see projected screens/documents/other Materials at the same time. [65] (in other words: coordination).

The difference between sitting across from each other, contrary to behind each other is essential for collaboration. Nevertheless, one must also consider the room's noise level, air quality, light conditions, and ability to move freely in the physical space. Again, depending on the existing infrastructure available, the room should be designed so that the collaboration does not strain the participants too much, and particular focus needs to be put on the overall noise level if members and groups is in the same physical learning space.

b) The difference between the learning spaces is huge considering f2f, hybrid, and online teaching, and this might be the biggest challenge when designing collaborative work using Ed. Tech. We will primarily consider hybrid spaces in this element since this learning space combines physical and online environments.

Firstly, it is noticeable that the problematic areas in a hybrid collaboration are not as present when doing textual work as when the groups are supposed to interact using audio-visual communication. This fact points to the most problematic to consider: ensuring that the Communication is sufficient for reaching the aims decided in the Learning design. Furthermore, obtaining good and equally experienced sound quality for all participants in a hybrid environment is challenging. Consequently, it is better to have groups either physically present or online to utilize the effects of the collaboration in the group. One also needs to remember that the physical spaces are different on the two sides (at home/remote location/in class): The sound is different, the image is different, the light conditions are different, and the synchronicity/technology is different. Thus the instructor needs to keep attention on both learning spaces simultaneously. The main effect will be that collaborative work needs to be allocated more Time.

Barriers and pitfalls are numerous when doing hybrid lectures, causing discussion for example, on the importance of keeping the camera on during lectures, mental overload for the teacher (concentration on more than one learning environment at the time), controlling the technology itself, monitoring various types of input from the students (raising hand in class, chatting online,

monitoring shared documents online) and more. In addition to the pedagogical challenges, one needs to consider the technology itself, like network connections and GDPR rules. To amend these difficulties, one should focus extra on the instructions provided (see bullet point 2) as well as the structure of the cases. Even if little research exists on hybrid learning spaces, we recommend that the lecturer spend extra time on the introductory phase. Here the instructor can define the collaboration concerning time, case structure, communication in all spaces, and type of facilitation. These measures can create an environment that allows for more fluent communication, better focus and concentration on sub-task, and, most importantly, allow participants to gain insight into how to collaborate efficiently.

c) When discussing cases, one of the instructors had an interesting observation concerning how to work in an online environment. When discussing if online teaching can function without video-conferencing, a lecturer at a university level claimed that video-conferencing is just a worse replica of physical presence. Implicit stating that video conferences can never achieve the same aims as a physical collaboration; thus, one should never seek to replace something with something that is not as good. Instead, one needs to find the inherent advantages in the learning environment available for the work.

d) Further reading on the topic [66], [67]

Wilson, H. K. and Cotgrave, A. J. (2020): Learning Space Design: The Presentation of a Framework for the Built Environment Discipline. *International Journal of Construction Education and Research, vol. 16/2*, pp. 132-148. DOI: https://doi.org/10.1080/15578771.2020.1727067

Støckert, R., Van der Zanden, P., & De Caro-Barek, V. (2020). An education spaces framework to define interactive and collaborative practices over the physical-hybrid-virtual continuum. *Proceedings of the 16th International Scientific Conference "ELearning and Software for Education," 1*, 486–496. https://doi.org/10.12753/2066-026X-21-061

a) Based on the European Commission's definition of necessary digital competencies for implementing digital tools in a learning environment, two areas especially need attention when designing a pedagogical approach in collaborative work.

Area 3: Teaching and Learning
Area 5 Empowering Learners

When doing collaborative work, all elements of Area 3 are essential, but the emphasis might be more on guidance than teaching in these situations. In light of G. Salmons's framework for online teaching, it is essential to consider Area 5, which empowers and emphasizes the learner's skills. Making information available, asking the correct questions, and allowing the students to use tools for differentiation and personalization are vital to succeed in this learning environment.

To succeed with the inclusion of Ed. Tech in collaborative learning environments, most instructors should update or increase their digital competencies. Perifanou (2021) defines six areas as vital for self-assessing your skills concerning digital competencies[68]

TECHNOLOGY	PEDAGOGY	ASSESSMENT	CONTENT	PROFESSIONAL DEVELOPMENT	LEARNER'S SUPPORT
Digital Tools & Devices	Pedagogical Approaches/Methods in Technology Enhanced Learning	Digital assessment of Language Learning skills	Search, evaluate & find digital language content	Organisation & communication	Facilitate learners to develop ICT for practicing language skills
Digital tools in Language Education	Pedagogical Approaches/Methods in Digital Language Learning and Teaching	Digital assessment strategies to monitor/assess language learners' progress	Use and store digital language content	Professional collaboration	Guide learners to develop and manage their digital identity
Social Media & Classroom collaboration platforms	Interactive Language Learning supported by technology	Digital assessment strategies to assess Language learners' achievements	Modify & create digital language content	Self-assessment & reflective practice	Guide learners to find, use, create and share language digital material respecting legal rules
Netiquette/Ethics	Collaborative Language Learning supported by technology	Learning Analytics strategies for Supporting Language Learning	Manage & share digital language content	CPD	Facilitate learners to foster communication & interaction skills
Security	Autonomous Language Learning supported by technology	Modes of digital feedback	Copyrights	Collaborate in projects with native speakers	Facilitate learners to foster collaboration skills

Figure 7 : A table showing thematic topics concerning digital skills, developed in the DC4LT-project

Ed. Tech is not solemn about using technology and knowing how the technology works, as the table in Figure 8. shows. We highly recommend considering all six areas during the educational year when Ed. Tech is in use, and making sure that you as an instructor can foresee and solve eventual problems that might occur.

b) There is a noticeable difference when delivering collaborative work in a digital versus physical environment, maybe especially considering the digital competencies needed to enhance the learning experience for all participants. Considering the table in Figure 8, it is mainly the first and the sixth topic, Technology and Learners support, that differ heavily from when using Ed.Tech in f2f-environments. Thus, the instructor should pay extra attention to increasing their competence in these areas and also be aware of how it is different to facilitate (see bullet point 8) a discussion in an online environment versus f2f.

c) When discussing cases and issues with implementing digital tools in a learning environment, several teachers mentioned the time-consuming effort of explaining to the learners how to use the tools and then starting the group work. These are the main issues when choosing a tool or even designing one. The chosen tool must be more or less self-explanatory or easily accessible for all involved learners. We recommend introducing and using the tool of choice early on in the learning process and sticking with the tool chosen to ensure expert users within the learner's group, allowing them to exploit all its features. Working with digital competencies both in the learner's group and among the instructors will create a better environment for exchanging ideas and good usage of tools. Furthermore, some tools are better suited for collaborative work, and others are for various specific purposes. For example, during the instructor's training, the STEM teachers were concerned about how the response technology tools (RT) allow for mathematical languages. These combo tools seem especially difficult to find; as a result, one needs to allocate extra time for the learners to use them and find the most valuable features to aid their work.

d) Further reading on the topic: [69], [70]

Støckert, R., Jensenius, A. R., Xambó, A., & Brandtsegg, Ø. (2019). A case study in learning spaces for physical-virtual two-campus interaction. *European Journal of Higher Education IT–EJHEIT, 1*.

Ester van Laar, Alexander J.A.M. van Deursen , Jan A.G.M. van Dijk, Jos de Haan (2017): . *Computers in Human Behaviour, pp. 577-588.* Elsevier

a) A part of the collaborative work should include statistics, both for the learners and the instructor. For the learners, this should be a part of the progress report to monitor the involvement and responsibility of each group member. It is natural to see this as an integral part of the project/workflow documentation, for example, via a timeline with a column for responsible members and/or through meeting minutes. This kind of monitoring is even more relevant for the instructor, seeing that it will be impossible for one or two instructors to continually oversee what all the groups are doing at all times. Even more important is the possibility of monitoring the learning progress throughout a specific period or over the years, which in turn scaffold the work with learning objective (learning design and aims, Instructions and Cases) more productive, more manageable and meaningful.
Hence, the instructor should always provide some reasoning for the collaborative work to make the learners more positive for participating. Statistics can be the reasoning, but sometimes it is feasible to include some elements with a theoretical background. Anchoring collaborative work and its benefits in theoretical perspectives may partly enhance the learner's motivation and engagement since they see the learning effects before starting the work.

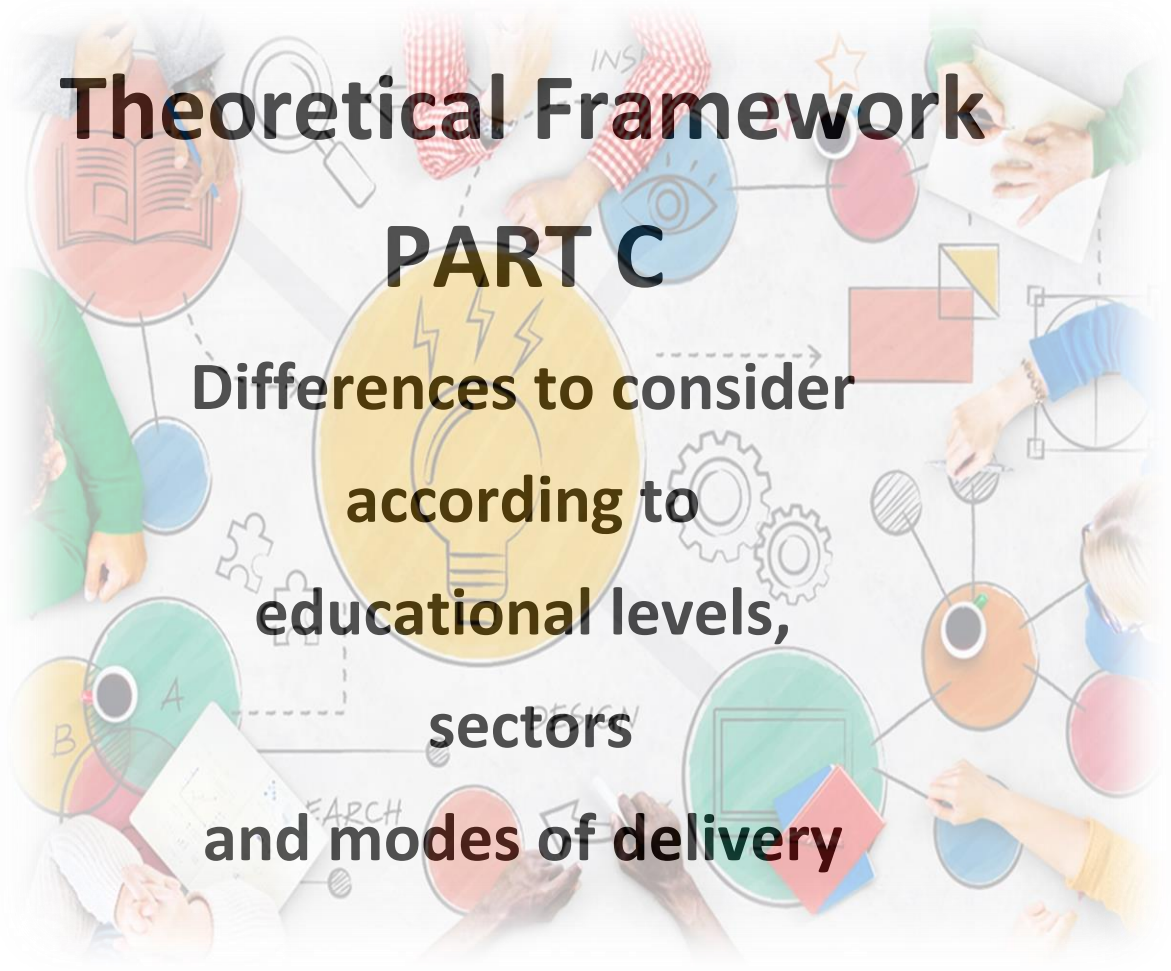
b) There is an obvious advantage to doing online training regarding statistics. Easy storage, archive systems, the ability to do recordings, and allowing learners to coordinate their work internally are systemized and fast when using digital tools. Additionally, the coordination of distributed materials can be efficient when doing online or hybrid teaching. For example, can almost any LMS sort and categorize files and articles, and the instructors can link directly to the document in chat or other tools or apps for sharing resources. This is a functionality that can enhance the learning outcome for the students immensely when appropriately used.

c) When instructors were asked if they use an LMS or similar to upload curricular elements, 36 of 46 attendees answered yes. This result was expected and not surprising, but the finding was elaborated during the discussions. Several instructors mentioned coordination as a positive effect of Ed. Tech in various ways. Furthermore, they stated that even if there is an abundance of different tools available, the tools need to be adapted or used in a good way to function positively. Otherwise, the technical difficulties and the sheer inclusion of an extra element might reduce the learning outcome. Therefore, when implementing technology to improve the distribution of and access to statistics and theory, the instructor should consider the effectiveness and coordinative function of the tool. The instructors also confirmed this statement with a mean score of 4,22 when asked how important the possibility of storing and sharing information is in collaborative work.

d) Further reading on the topic [71], [72]

Simpson, C., & Du, Y. (2004). Effects of Learning Styles and Class Participation on Students' Enjoyment Level in Distributed Learning Environments. Journal of Education for Library and Information Science, 45(2), 123–136. https://doi.org/10.2307/40323899

Rienties, B., Nguyen, Q., Holmes, W., & Reedy, K. (2017). A review of ten years of implementation and research in aligning learning design with learning analytics at the Open University UK. Interaction Design and Architecture (s), 33, 134-154.



Theoretical Framework

PART C

Differences to consider according to educational levels, sectors and modes of delivery

PART C: Differences to consider according to educational levels, sectors and modes of delivery

When designing a pedagogical strategy for implementing Ed. Tech in collaborative work, it is necessary to remember that different levels of the education system, delivery modes, and educational sectors foster different needs and demands. Therefore, in this part, we will provide some insight into the main differences in our research concerning the abovementioned elements.

The main idea in this part is to identify what is needed to make a collaborative work function best. Ideas presented in this part C include using Educational Technology and, simultaneously, considering the effects of Ed. Tech has on collaboration. This part will only include elements not mentioned and discussed in parts A and B.

Part C divides into three paragraphs; one analyzing differences between different sectors (HE, VET, adult, and other), one that looks specifically at modes of delivery and especially the difference between f2f and hybrid delivery, and one paragraph that comments briefly on different levels in the educational system.

The materials and discussions are based on a twofold methodology:

1) Semi-Structured literature review (a string of keywords: (“Ed. Tech” + “Collaborative work work”) + the sector searched (VET, Adult, High School, and Higher Education). The literature was searched freely online, just in order to get an overview. Each partner investigated and read at least five articles found in each search.
2) Secondly, the findings (very scarce) were discussed in semi-structured interviews/talks with instructors at different levels/sectors.

All results were collected in a matrix designed to find essential areas and see apparent and interesting differences between the areas. In general, few results were worth mentioning, at least when considering the significant differences necessary to adjust according to recommendations made in part B of this strategy. The main differences link to age, study experience, and practical knowledge. However, we find more severe differences between hybrid delivery and f2f than between f2f and online. The literature otherwise underlines findings in part B of this strategy.

Educational sectors

Presumably, there should not be significant differences between sectors or levels in the educational sector considering the pedagogical approach when doing collaborative work with included Ed. Tech. One would perhaps assume that age, occupation, work experience, and motivation variances would influence how the collaboration works, but there are a few differences worth considering from one level to another. Furthermore, there are still some findings worth mentioning.

Considering the materials provided, VET learners are more dependent on these than others regarding accessibility to more and other types of materials, especially videos, and manuals for practical work. Accordingly, there is a difference between Higher Education + Adult-students and High School and VET students considering knowledge about netiquette. However, digital competence seems to be higher in general in the first group. (HE)

Along the same lines, one can see the amount of previous training received concerning the use of digital tools. The distribution indicates that High School and VET-level instructors must pay extra attention in the pre-phase when implementing Ed. Tech to collaborative work.

At last, it is worth mentioning that literature seems to point to the fact that adult students demand higher quality feedback than the other educational sectors. The comments need to be constructive. Thus, it is even more important to stress the quality of the formative assessment when instructing adult students.

Educational level

Maturity is an obvious factor, especially when considering roles in the group. Even if several teachers claim that there will always be at least one participant taking the leader role and ensuring coordination and execution of the tasks, it is evident that high-school-level instructors are more concerned that the tasks will be done and delivered on time than at the other levels. Therefore, it may be an indication to be more precise on task delegation and role allocation at high school than what is necessary in, for example, HE. Considering communication in the group, the younger the students are, the more critical the facilitation is when introducing Ed. Tech. Especially the lack of netiquette can hinder good communication, often related to bullying and turn-taking. So, aiming at active participation and ensuring that all voices are heard is crucial. In lower age groups, the instructor is especially aware of giving the same experience to all participants. Attention to all attending needs to be a mantra.

Modes of delivery

A response tool designed for collaborative work, like iLikeIT2, will be a glue that maintains and facilitates human interaction and group work when moving between a F2F into a hybrid and online learning scenario. The functionality of iLikeIT2 will preserve valuable interaction and collaborative activities in the transition phases and deliver valuable feedback to the teacher from activities within all learning spaces. Therefore it is interesting to consider differences in delivery and especially look at difficulties with hybrid delivery modes.

We need to remember that digital collaborative tools will draw on the digital skills/competencies already present in the student group. The new generation getting into high school and higher education is part of generation z, digital natives. Adults have the will and motivation, but maybe not the skills to the same degree. Thus the tools need to be used to enhance the learning experience for this group. One should also consider that these students already have experienced some hybrid teaching and therefore have some pre-knowledge and thoughts about this form of lecture. One of the biggest challenges will undoubtedly be the experienced equality in hybrid learning environments (especially connected to spaces and audio/video). In order to make a hybrid space work, one needs to deliver and receive the same experienced quality for all participants, which is challenging since some students are physically present and others participate online. Therefore, functionalities in the tool must deliver equal possibilities for all groups and be used to enable students to feel active participation independent of their present location.

One also needs to consider materials beneficial for collaborative work. The access to external materials is enormous online and more accessible than for students participating solemnly in the classroom. The tool needs to foster the same access to essential information and materials throughout the whole-time frame of the collaboration.

Part D: Recommendations for implementation of Educational Technology in the classroom

Even if collaborative work is well known and renowned at all levels of the educational system, there are always ways to improve it. When introducing and implementing Ed. Tech in collaborative work, there are many things to remember and consider. In the following part of this pedagogical strategy, results from the previous parts will be refined and condensed into 15 clear recommendations available as a kind of checklist for all levels of the educational system, with a particular focus on higher education. Accordingly, different moods of delivery are accounted for, based on the theoretical framework presented in part A.

When introducing and implementing Ed. Tech

1. in collaborative work, include the 3C`s. Communication, Coordination, and Collaboration.

2. In digital learning environments, tasks/cases should allow for a monitoring role more than a facilitating/participative role for the instructor.

3. Design all tasks to enable all participants to be seen/heard, ensuring the same quality/effects of the learning experience for all. (For example, this can be done via asynchronous lectures (available online resources) when the curriculum/theory is the main element of the lecture.)

4. Assessment is always tricky in collaborative work. Group assessment is easier to do with high quality than individual assessment. However, it is vital to allow all groups to present their final product and enhance positive feedback in a plenary setting. Utilizing strengths in tools implemented will make it easier to assess the whole process, as long as the students have been given time to learn the skills necessary for using the functionalities.

5. The assessment must be based on the task provided. It needs to include at least a discussion on the difference in assessment between the process and results. It must be a formative assessment considering participation, process, results, and the end product. The assessment should also focus on using opportunities provided in the tool of choice.

6. All cases and tasks provided need to be designed to allow both cooperation and individual work. These kinds of features are one of the inherent advantages that Ed. Tech provides and needs to be utilized to its fullest.

7. One of the most important recommendations is to provide small training tasks before the participants start work. The training should be directed towards turn-taking, attention to the speaker, and ways of coordinating the work, especially considering sharing of materials. These elements are essential when doing an online collaboration.

8. Digital competencies are an obvious factor both for students and instructors. If there is a discrepancy between the experience in a group, one should cater to this and ensure that all involved participants have an adequate level for participating actively in the work.

9. Including statistics and previous theories/results will enhance the collaboration. Additionally, the coordinative factor is elevated when utilizing Ed. Tech like LMSs or videoconferencing with chat functionality, thus making it easier to delegate tasks between the students. At the same time, provide material to help the instructor design the tasks.

10. Do not invent the wheel. However, look at the pedagogy wheel. Many tools are available for collaborative work, and as an instructor, you should use an existing tools. In addition to training students in the usage of them, one should focus on using them to better the performance when it comes to coordination, communication and collaboration. This will in turn better the pedagogics when using Ed.Tech in collaborative work.

11. Maybe the most important recommendation is that the learning design needs to facilitate for using opportunities found in the introduced Ed.Tech. One needs to find new ways of using ED.Tech in order to reach a higher learning aim than possible in traditional lectures.

12. When providing materials you need to think about different levels of the educational system. VET and adult learners are more dependent on animated materials and videos, and more practical oriented then Higher Education and High school students. Ed.Tech. allows for differentiated ways of distribution.

13. Both qualitative and the quantitative data points at the coordinative functions found in Ed.Tech-tools are the single most important innovations for collaborative work. Thus, the coordinative role in the group is more important. Make sure you always include one strong coordinator in each group. It is important to consider the coordinative role in the group when dividing members. Introducing Ed.Tech. makes this role more complex and important then in more conservative collaborative environments.

14. When doing online work, remember to allocate more time than in other modes. Videoconferencing fatigue and reduced attention span will influence the possibility of reaching the learning aim for the work.

15. Active learning is the key to deliver a good collaborative work. When using Ed.Tech one should always look for functionalities that allow the group to divide tasks into smaller pieces, and at the same time keep their attention on the common work being done.

References

[1] European Commission. Directorate General for Education and Culture. and High level group on the modernisation of higher education., *Report to the European Commission on new modes of learning and teaching in higher education.* LU: Publications Office, 2014. Accessed: May 22, 2023. [Online]. Available: https://data.europa.eu/doi/10.2766/81897

[2] European Commission, *High Level Group on the Modernisation of Higher Education :report to the European Commission on improving the quality of teaching and learning in Europe's higher education institutions*. LU: Publications Office of the European Union, 2013. Accessed: May 22, 2023. [Online]. Available: https://data.europa.eu/doi/10.2766/42468

[3] T. Anderson and J. Dron, "Three generations of distance education pedagogy," *IRRODL*, vol. 12, no. 3, p. 80, Mar. 2011, doi: 10.19173/irrodl.v12i3.890.

[4] C. L. Scott, "The Futures of Learning 3: what kind of pedagogies for the 21st century? - UNESCO Digital Library," 2015. Accessed: Jan. 11, 2023. [Online]. Available: https://unesdoc.unesco.org/ark:/48223/pf0000243126

[5] C. Leadbeater and A. Wong, "Learning from the Extremes," 2010.

[6] A. Januszewski, M. Molenda, and Association for Educational Communications and Technology, *Educational technology : a definition with commentary*. New York: Routledge, 2008.

[7] P. Costa, J. Castaño-Muñoz, and P. Kampylis, "Capturing schools' digital capacity: Psychometric analyses of the SELFIE self-reflection tool," *Computers & Education*, vol. 162, p. 104080, Mar. 2021, doi: 10.1016/j.compedu.2020.104080.

[8] A. W. (Tony) Bates and A. W. Bates, "A.2 What is a learning environment?," Apr. 2015, Accessed: May 22, 2023. [Online]. Available: https://opentextbc.ca/teachinginadigitalage/chapter/5-2-what-is-a-learning-environment/

[9] J. L. Moore, C. Dickson-Deane, and K. Galyen, "e-Learning, online learning, and distance learning environments: Are they the same?," *The Internet and Higher Education*, vol. 14, no. 2, pp. 129–135, Mar. 2011, doi: 10.1016/j.iheduc.2010.10.001.

[10] G. Salmon, *E-tivities: The Key to Active Online Learning*, 2nd ed. New York: Routledge, 2013. doi: 10.4324/9780203074640.

[11] J. Traxler, "The 'learner experience'of mobiles, mobility and connectedness,'" in *Background paper to presentation ELESIG symposium: Digital futures*, 2010.

[12] A. Kukulska-Hulme and C. Jones, "The next generation: Design and the infrastructure for learning in a mobile and networked world," Aug. 2011.

[13] A. D. Olofsson and J. O. Lindberg, *Informed Design of Educational Technologies in Higher Education: Enhanced Learning and Teaching*. IGI Global, 1AD. Accessed: May 22, 2023. [Online]. Available: https://www.igi-global.com/book/informed-design-educational-technologies-higher/www.igi-global.com/book/informed-design-educational-technologies-higher/51938

[14] E. Einum, *Response Technology and Student-centring of Language Education*, Docotoral thesis. NTNU. [Online]. Available: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/2635594/Even%20Einum_fulltext.pdf

[15] J. S. Bruner, "The act of discovery," *Harvard Educational Review*, vol. 1, no. 31, pp. 21–32, 1961.

[16] J. R. Savery, "Overview of Problem-based Learning: Definitions and Distinctions," *Interdisciplinary Journal of Problem-Based Learning*, vol. 1, no. 1, May 2006, doi: 10.7771/1541-5015.1002.

[17] G.-J. Hwang, L.-Y. Chiu, and C.-H. Chen, "A contextual game-based learning approach to improving students' inquiry-based learning performance in social studies courses," *Computers & Education*, vol. 81, pp. 13–25, Feb. 2015, doi: 10.1016/j.compedu.2014.09.006.

[18] B. Zimmerman, "Self-Regulated Learning and Academic Achievement: An Overview," *Educational Psychologist - EDUC PSYCHOL*, vol. 25, pp. 3–17, Jan. 1990, doi: 10.1207/s15326985ep2501_2.

[19] D. Radcliffe, "A pedagogy-space-technology (PST) framework for designing and evaluating learning places," in *Learning spaces in higher education: Positive outcomes by design: Proceedings of the Next Generation Learning Spaces 2008 Colloquium*, University of Queensland Brisbane, 2008, pp. 9–16.

[20] S. Yahya, E. Ahmad, and K. Abd Jalil, "The definition and characteristics of ubiquitous learning: A discussion," *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 6, pp. 117–127, Jan. 2010.

[21] D. Thomas and J. S. Brown, *A new culture of learning: Cultivating the imagination for a world of constant change*, vol. 219. CreateSpace Lexington, KY, 2011.

[22] T. Talmo, G. S. Korpås, M. Mellingsæter, and E. Einum, "Experiences with use of new digital learning environments to increase academic and social competence," in *ICERI2012 Proceedings*, IATED, 2012, pp. 4540–4545.

[23] R. C and P. Y, "European Framework for the Digital Competence of Educators: DigCompEdu," Publications Office of the European Union, Luxembourg (Luxembourg), Scientific analysis or review, Policy assessment, Technical guidance KJ-NA-28775-EN-C (print),KJ-NA-28775-EN-N (online), 2017. doi: 10.2760/178382 (print),10.2760/159770 (online).

[24] "assessment," May 24, 2023. https://dictionary.cambridge.org/dictionary/english/assessment (accessed May 25, 2023).

[25] C. Boston, "The Concept of Formative Assessment," vol. 8, no. 9, Aug. 2002, doi: 10.7275/KMCQ-DJ31.

[26] G. Amigoni, "Physical, Digital, and Hybrid Workspaces: From the Process of Creation to the Process of Use," in *Dynamic Capabilities and Relationships: Discourses, Concepts, and Reflections*, T. Bayón, M. Eisend, J. Koch, A. Söllner, M. Vodosek, and H.-T. Wagner, Eds., in Contributions to Management Science. Cham: Springer International Publishing, 2021, pp. 127–143. doi: 10.1007/978-3-030-83182-0_8.

[27] A. Cohen, R. Nørgård, and Y. Mor, "Hybrid learning spaces -- Design, data, didactics," *British Journal of Educational Technology*, vol. 51, Jun. 2020, doi: 10.1111/bjet.12964.
[28] R. Støckert, A. Bergsland, and A. Xambo Sedo, *The Notion of Presence in a Telematic Cross-Disciplinary Program for Music,Communication and Technology*. Cappelen Damm Akademisk, 2020. doi: 10.23865/noasp.108.
[29] E. Mortimer and P. Scott, *Meaning Making in Secondary Science Classroom*. 2003.
[30] N. Mercer, "Sociocultural Discourse Analysis: Analysing Classroom Talk as a Social Mode of Thinking," *Journal of Applied Linguistics*, vol. 1, pp. 137–168, May 2004, doi: 10.1558/japl.2004.1.2.137.
[31] G. Conole, "Learning design – making practice explicit," Jun. 2010.
[32] K. J. Wilson, P. Brickman, and C. J. Brame, "Group Work," *LSE*, vol. 17, no. 1, p. fe1, Mar. 2018, doi: 10.1187/cbe.17-12-0258.
[33] M. Uduafemhe, *TEACHING TRADE SUBJECTS WITH LEARNER- CENTRED METHODS: A CASE FOR SCAFFOLDING AND COLLABORATIVE INSTRUCTIONAL APPROACHES TEACHING TRADE SUBJECTS WITH LEARNER-CENTRED METHODS: A CASE FOR SCAFFOLDING AND COLLABORATIVE INSTRUCTIONAL APPROACHES*. 2021.
[34] M. D. Gross *et al.*, "Collaboration and coordination in architectural design: approaches to computer mediated team work," *Automation in Construction*, vol. 7, no. 6, pp. 465–473, Sep. 1998, doi: 10.1016/S0926-5805(98)00055-7.
[35] J. Yahaya, M. Basir, and A. Deraman, "Unified Communication and Collaboration Model for Virtual Distributed Team Work: A Study in Malaysia," *International Journal of Software Engineering and Its Applications*, vol. 9, pp. 125–142, Feb. 2015, doi: 10.14257/ijseia.2015.9.2.11.
[36] "Formulating Research Aims and Objectives," *Research-Methodology*. https://research-methodology.net/research-methodology/research-aims-and-objectives/ (accessed May 30, 2023).
[37] "Zone of Proximal Development - an overview | ScienceDirect Topics." https://www.sciencedirect.com/topics/psychology/zone-of-proximal-development (accessed May 30, 2023).
[38] N. Geri, A. Winer, and B. Zaks, "Challenging the six-minute myth of online video lectures: Can interactivity expand the attention span of learners?," *Online Journal of Applied Knowledge Management ISSN 2325-4688*, vol. 5, pp. 101–111, May 2017, doi: 10.36965/OJAKM.2017.5(1)101-111.
[39] W. Littlewood, "The task-based approach: some questions and suggestions," *ELT Journal*, vol. 58, no. 4, pp. 319–326, Oct. 2004, doi: 10.1093/elt/58.4.319.
[40] S. Kim, W. R. Phillips, L. Pinsky, D. Brock, K. Phillips, and J. Keary, "A conceptual framework for developing teaching cases: a review and synthesis of the literature across disciplines," *Medical Education*, vol. 40, no. 9, pp. 867–876, 2006, doi: 10.1111/j.1365-2929.2006.02544.x.
[41] S. Kagan, *Kagan Cooperative Learning*. San Clemente, CA: Kagan Cooperative Learning, 1994.
[42] J. Peltokorpi and E. Niemi, "Effects of group size and learning on manual assembly performance: an experimental study," *International Journal of Production Research*, vol. 57, no. 2, pp. 452–469, Jan. 2019, doi: 10.1080/00207543.2018.1444810.
[43] X. S. Apedoe, M. R. Ellefson, and C. D. Schunn, "Learning Together While Designing: Does Group Size Make a Difference?," *J Sci Educ Technol*, vol. 21, no. 1, pp. 83–94, Feb. 2012, doi: 10.1007/s10956-011-9284-5.
[44] M. Saqr, J. Nouri, and I. Jormanainen, "A Learning Analytics Study of the Effect of Group Size on Social Dynamics and Performance in Online Collaborative Learning," in *Transforming Learning with Meaningful Technologies*, M. Scheffel, J. Broisin, V. Pammer-Schindler, A. Ioannou, and J. Schneider, Eds., in Lecture Notes in Computer Science. Cham: Springer International Publishing, 2019, pp. 466–479. doi: 10.1007/978-3-030-29736-7_35.
[45] J. G. M. Kooloos, T. Klaassen, M. Vereijken, S. Van Kuppeveld, S. Bolhuis, and M. Vorstenbosch, "Collaborative group work: effects of group size and assignment structure on learning gain, student satisfaction and perceived participation," *Med Teach*, vol. 33, no. 12, pp. 983–988, 2011, doi: 10.3109/0142159X.2011.588733.
[46] S. K., "A study at the digital gadget addiction of youth in south India," Sep. 2016.
[47] M. Tinzmann, B. Jones, T. Fennimore, J. Bakker, and J. NCREL, "What Is the Collaborative Classroom?," Jan. 1990.
[48] E. Sormunen, T. Alamettälä, and J. Heinström, "The Teacher's Role as Facilitator of Collaborative Learning in Information Literacy Assignments," in *Worldwide Commonalities and Challenges in Information Literacy Research and Practice*, S. Kurbanoğlu, E. Grassian, D. Mizrachi, R. Catts, and S. Špiranec, Eds., in Communications in Computer and Information Science. Cham: Springer International Publishing, 2013, pp. 499–506. doi: 10.1007/978-3-319-03919-0_67.
[49] N. Zanjani, S. L. Edwards, S. Nykvist, and S. Geva, "LMS Acceptance: The Instructor Role," *Asia-Pacific Edu Res*, vol. 25, no. 4, pp. 519–526, Aug. 2016, doi: 10.1007/s40299-016-0277-2.
[50] M. Brown, "The facilitator as gatekeeper: A critical analysis of social order in facilitation sessions," *Journal of Adventure Education & Outdoor Learning*, vol. 2, pp. 101–112, Jan. 2002, doi: 10.1080/14729670285200211.
[51] R. Schwarz, "Using facilitative skills in different roles," *The skilled facilitator fieldbook: Tips, tools, and tested methods for consultants, facilitators, managers, trainers, and coaches*, pp. 27–32, 2005.
[52] D. Hunter, *The art of facilitation: The essentials for leading great meetings and creating group synergy*. John Wiley & Sons, 2009.
[53] L. S. Vygotsky, M. Cole, V. John-Steiner, S. Scribner, and E. Souberman, *Mind in Society: Development of Higher Psychological Processes*. Manchester: Harvard University Press, 1978.
[54] F. Korzenny, "A Theory of Electronic Propinquity: Mediated Communication in Organizations," *Communication Research*, vol. 5, no. 1, pp. 3–24, Jan. 1978, doi: 10.1177/009365027800500101.

[55] J. Walther and N. (Natalie) Bazarova, "Validation and application of electronic propinquity theory to computer-mediated communication in groups.," *Communication Research*, vol. 35, pp. 622–645, Oct. 2008, doi: 10.1177/0093650208321783.
[56] T. Talmo, Ø. Marøy, and H. R. Karlsen, "Designing Learning Environments in a Digital Time – Experiences in Two Different Subjects at NTNU, Norway Autumn 2020," in *Learning and Collaboration Technologies: New Challenges and Learning Experiences*, P. Zaphiris and A. Ioannou, Eds., in Lecture Notes in Computer Science. Cham: Springer International Publishing, 2021, pp. 531–546. doi: 10.1007/978-3-030-77889-7_37.
[57] M. Saha, "Perceptions about Learners' Roles and Functions in Online Higher Education: A Qualitative Research Required," *Journal of Teaching & Teacher Education*, vol. 7, Jan. 2019, doi: 10.12785/jtte/070101.
[58] N.-F. Liu and W. Littlewood, "Why do many students appear reluctant to participate in classroom learning discourse?," *System*, vol. 25, no. 3, pp. 371–384, Sep. 1997, doi: 10.1016/S0346-251X(97)00029-8.
[59] E. Einum, "Discursive lecturing: An agile and student-centred teaching approach with response technology," *J Educ Change*, vol. 20, no. 2, pp. 249–281, May 2019, doi: 10.1007/s10833-019-09341-7.
[60] H. Uzunboylu and D. Karagozlu, "Flipped classroom: A review of recent literature," *WJET*, pp. 142–147, Aug. 2015, doi: 10.18844/wjet.v7i2.46.
[61] M. J. Lage, G. J. Platt, and M. Treglia, "Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment," *The Journal of Economic Education*, vol. 31, no. 1, pp. 30–43, 2000, doi: 10.2307/1183338.
[62] K. Bjørkli and K. Arnesen, "Kombinert summativ og formativ vurdering i matematikk," *Uniped*, vol. 38, no. 4, pp. 337–344, Nov. 2015, doi: 10.18261/ISSN1893-8981-2015-04-10.
[63] R. E. Bennett, "Formative assessment: a critical review," *Assessment in Education: Principles, Policy & Practice*, vol. 18, no. 1, pp. 5–25, Feb. 2011, doi: 10.1080/0969594X.2010.513678.
[64] "Benefits of Online Assessment | E-Assessment | TestReach." https://www.testreach.com/benefits-of-online-assessment-testreach.html (accessed Jun. 01, 2023).
[65] E. Sanchez, E. Paukovics, L. Cheniti-Belcadhi, G. El Khayat, B. Said, and O. Korbaa, "What do you mean by learning lab?," *Educ Inf Technol*, vol. 27, no. 4, pp. 4501–4520, May 2022, doi: 10.1007/s10639-021-10783-x.
[66] H. K. Wilson and A. J. Cotgrave, "Learning Space Design: The Presentation of a Framework for the Built Environment Discipline," *International Journal of Construction Education and Research*, vol. 16, no. 2, pp. 132–148, Apr. 2020, doi: 10.1080/15578771.2020.1727067.
[67] R. Støckert, P. Van der Zanden, and V. De Caro-Barek, "An education spaces framework to define interactive and collaborative practices over the physical-hybrid-virtual continuum," in *Proceedings of the 16th International Scientific Conference "eLearning and Software for Education,"* Bucharest: Editura Universitara, 2020, pp. 486–496. doi: 10.12753/2066-026X-21-061.
[68] M. Perifanou, *Digital Competence Assessment Framework & Tool for Language Teachers*. 2022. doi: 10.13140/RG.2.2.29026.81602.
[69] R. Støckert, A. Refsum Jensenius, A. Xambó Sedó, and Ø. Brandsegg, "A case study in learning spaces for physical-virtual two-campus interaction," in *European Journal of Higher Education IT 2019-1*, M. von der Heyde, Ed., May 2020. Accessed: Mar. 08, 2021. [Online]. Available: https://www.eunis.org/erai/2019-1/
[70] E. van Laar, A. J. A. M. van Deursen, J. A. G. M. van Dijk, and J. de Haan, "The relation between 21st-century skills and digital skills: A systematic literature review," *Computers in Human Behavior*, vol. 72, pp. 577–588, Jul. 2017, doi: 10.1016/j.chb.2017.03.010.
[71] C. Simpson and Y. Du, "Effects of Learning Styles and Class Participation on Students' Enjoyment Level in Distributed Learning Environments," *Journal of Education for Library and Information Science*, vol. 45, no. 2, pp. 123–136, 2004, doi: 10.2307/40323899.
[72] B. Rienties, Q. Nguyen, W. Holmes, and K. Reedy, "A review of ten years of implementation and research in aligning learning design with learning analytics at the Open University UK," *Interaction Design and Architecture(s)*, pp. 134–154, Jun. 2017, doi: 10.55612/s-5002-033-007.

Appendix A: Cases for Higher Education

Case 1

File name: Best case - Higher Education 1

Title and short description: Politics. How to create a solid argumentation in teams?

Learning objective/aims	The main aim for the collaborative work is to learn argumentative techniques. In order to do this the students need to participate with own ideas as well as reach common conclusions after having reflected on the ideas exposed. The learning objectives for the task is to identify students capacity to work in a team, debate, listen to others, understand, position themselves, and to argue their case. This will increase the capacity to think for themselves.
Instructions	The instructor needs to clarify the aim of the task. Important to focus on the roles in the group, and that the main aim is not to "win" the discussion, but to formulate good and valid arguments. Accordingly the instructor needs to explain that the most valid arguments will be emphasized in the plenary summary after the debate. The groups need to be aware of the fact that they are doing both a topic introduction and a discussion with arguments afterwards. They are instructed to create a 2 minute introduction where they focus on their main argument. They also need to prepare for different other opinions from other groups, as well as collect facts about the topic in hand to be able to drive the discussion forwards. All groups are to present their main statements before the discussion begins. It is an idea to instruct the groups to provide one counter-argument to each of the other groups.
Materials beneficial for collaboration	Resources about the topic to be shared (video, image, article). A link is generated and shared with students to enable them direct access to the content posted. If possible in the chosen tool all materials should be uploaded and shared to all groups commonly
Cases – structure	In this case, the main learning outcome will be concentrated on collaboration and argumentation. Thus the case needs to be open-ended without any clear solution in order to foster discussions. The instructor also needs to create a case that opens up for more than one opinion. The structure of the case needs to include clear directions for the topic statement so that the 2 minutes is well spent, and also provide opportunities to be creative in which facts are stated and validated in the discussion.

Group size	5 students per group
Time scale	90 minutes
Instructor role	Facilitating the collaboration, and moderating the debate. The instructor should also comment on the arguments being presented in plenary.
Facilitation	To allow students to speak and transmit their opinions in a comfortable manner. To motivate students to participate, and also interfere when arguments are outside the topic and/or targeting persons instead of discussion points. give each participant a turn to speak. In the debate the facilitator might ask open questions such as: - *And why do you think your opponent is not right?* - *And why do you prefer one action to the other?* - *How likely is it that...?* - *Can you give me an example of what you are saying?* The facilitator should make an attempt to conclude on the 3 factors that everyone understands as the most vital for successful communication.
Communication	Group discussions. Plenary debate between the different groups, with one group leader and a coordinative function that can help sort the arguments to be presented. Plenary discussion of the end definition.
Learner roles	Participants will first comment on their ideas regarding the topic. They might learn new ideas from listening to those of their mates and reach a better outcome. It will be necessary to divide groups with a clear leader that can argue with other groups, and several resource investigators in each group. If possible, a coordinative participant in each group might be the most important. This role needs to do notes, initiate work amongst the others and keep track of the discussion points in order to create a useful and insightful discussion
Pedagogy	Inquiry based learning, based mainly on peer learning. One should apply a constructivist view seeing participants needs to formulate their own arguments without any external help.
Assessment/ feedback	Formative assessment. All groups definitions to be presented in plenary and assessed/discussed by peers. It is difficult to summarize and grade this type of task, and it is more useful to understand the arguments from peers than receiving elaborated feedback from the instructor. The only thing that will be positively punctuated is that participants join the discussion and participate in it.

Room structure	Computer, internet connection, round tables. In the debate the room needs to be adjusted so that the participants can look at each other when delivering their arguments. If possible it might be an idea to include a handheld microphone. This will both provide better sound and function as a turn-taking-tool.
Technical competencies/ digital skills	In this case it totally depends on the tools applied in the collaborative work. It is necessary to remember that pupils have different competence in searching for relevant information, this can be mitigated via the materials delivered beforehand. If available one can introduce a response tool to vote for the best arguments, which requires some insight into digital skills from both instructor and pupils.
Statistics and theory	In the case no theory is absolutely necessary. Still, the topic being discussed needs to be prepared, and some theory on debate technique should be presented. Statistics on the group involved should be applied, especially in order to delegate coordinative roles in each group. One should also try to monitor, preferably digital, the talking time from each group/student. This can aid the work next time.

Case 2

File name: Best case – Higher Education 2

Title and short description: Academic writing. How to assess your own writing?

Learning objective/aims	The main aim of the collaborative work is to make the students more aware of their strengths and problems when writing academic texts. This will aid their self-regulative learning over time. The learning objectives are manyfold in this case: Allow students to heighten their knowledge of assessment Provide good examples of academic texts Better knowledge on argumentation in academic writing Enhance students ability of self-regulated learning
Instructions	Students provided three documents all together; One text written by a student at the same level, instructions for the text written, and a rubric used by the instructor in order to evaluate. First the students read the text, and grade it individually using a educational tool of instructors choice. Secondary the instructor explains the rubric, and highlights what is most useful to look for in the text. Students are then asked to discuss inside the tool chosen about the text. Asked mainly to focus on the elements in the rubric, not the grade. After ten minutes of discussion they are asked to vote for the grade again. The teacher then assesses the text in plenary, and comments on the results from the two votes.
Materials beneficial for collaboration	Shared document – Rubric for assessment Projected screen – The assignment Printed materials – A subject text
Cases – structure	Assessment is a vital part of every study, meaning this case is not open-ended. The instructor will have graded the text(s) provided before the work begins, and the structure needs to be in a way that leads the students towards the correct answer. Still, including both group and plenary discussions, the students will be able to provide their own insights and ideas.
Group size	5 in groups, periods in plenary
Time scale	60 minutes
Instructor role	Involved in three different plenary sessions. Other than that only monitoring

Facilitation	Stress the fact that the group should reach an agreement based on the best arguments with proof in the subject text. Instructor provides materials, and instructions. No interference in the discussion, if not to clarify the task.
Communication	Online chatting. Explanation from some groups in plenary, depending on time.
Learner roles	Important to remember that their will be students better than others in arguing their case. Allow for a leader in the group that controls time, but make sure that all students participate.
Pedagogy	Peer instruction. Active learning
Assessment/ feedback	Instructor comments on both votes after the discussions. Especially interesting if many students have changed their minds after the initial discussion period. Make sure to highlight the argumentation in the text as the main point, included validation and reliability for the argument.
Room structure	Computer, internet connection, round tables. In-class teaching. Students at their seats in order to have a common focal area at the instructors place. The focus will be the documents, both on the shared screen if applicable in the tool and at the projected screen where the instructor is located.
Technical competencies/ digital skills	Basic skills. Accessing the internet, connecting via chat and handling easy scrolling and voting.
Statistics and theory	Access to taxonomy for grading. Explanation about the assessment via rubrics from instructor. Teachers assessment in plenary at the end.

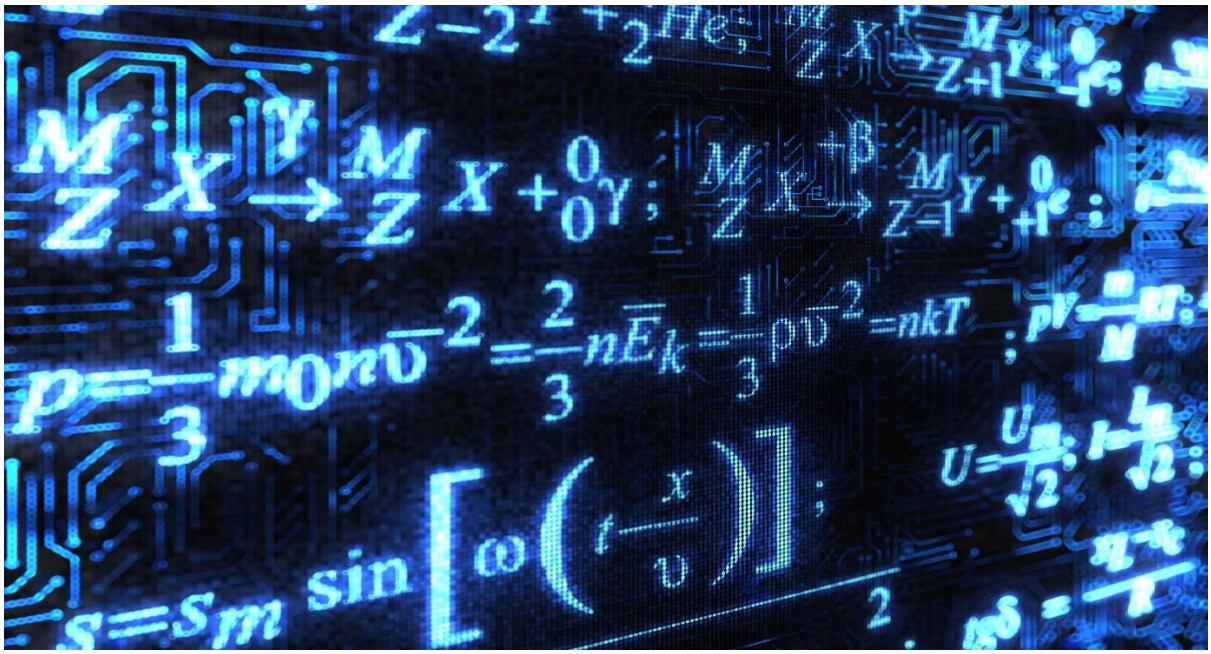
File name: Best case -Higher Education

Title and short description: Communication in Mathematics

Learning objectives	The main aim for the collaborative work is to allow students to understand the language of Mathematics better. Learning objectives are connected to the curricular element being taught in the period. Additionally students will practice arguing for correct solutions using mathematical evidence and language.
Instructions	The students solve a set of problems individually. Their individual solutions are collected with the help of a response tool of choice. The initial results are not communicated with the students, something that needs to be explained by the instructor. Secondly the students are grouped in four and discuss some of or all the problems. The instructor selects which problems based on the collected answers. The instructor needs to inform the students that group answers are also collected via the response tool, and that discrepancies with the initial vote is OK. The results are the presented to the students in plenary, where problems will be highlighted by the instructor. Instructions should contain rules for further discussion in plenary.
Materials beneficial for collaboration	Printed documents with the tasks.
Cases -structure	The cases will be dependent on the curriculum being taught. The structure is provided in instructions. It is important that the cases provide opportunities for several ways to the correct answer, and that they test understanding of mathematics more than accuracy in calculation.
Group size	4 in groups, periods in plenary
Time scale	60 minutes
Instructor role	The instructors role is important in this collaborative work. In addition to preparing the pre-phase, the instructors needs to be active during the group discussions in order to guide the students in the right direction if they are lost/heading the wrong way. The instructors needs to assess the initial votes immediately in order to identify the problematic cases that needs to be discussed in plenary.

Instructor role	Finally the instructor leads the final session of discussions, and provide the (most) correct way of solving the problem.
Facilitation	The facilitation of the session is less of a challenge than the instructor role. As long as the cases are well prepared, and the problems are relevant for the students, the main facilitation is connected to making sure all students are heard during the discussions. Additionally the facilitator needs to define time, run the digital system and prepare interesting questions for plenary discussions.
Communication	Even if these are ordinary classroom activities, there are some extra communicative elements to consider. Seeing all students needs to be placed in the same classroom, there will be some additional noise in the session where the students are placed in groups. Thus there neds to be some rules for these discussions. Internally in the group the instructor also has to make sure that all students are heard. In plenary it is positive if some of the groups present their solutions, to initiate some sort of discussion between the peers. At the closure, the instructor need to correct inaccuracies, but still allow for arguments to be presented.
Learner roles	Important to remember that there will be students better than others in arguing their case. This van be mitigated through allowing for individual votes in the first phase. Also the instructor should allow more students to participate freely in the plenary discussions. There needs to be a designated leader in the groups, that can help control time, turn-taking and take notes of the most valid arguments for further discussions in the plenary.
Pedagogy	The case shows an active learning with peer instructions approach. This activity gives the teacher a better insight in the students understanding of the given problems, and provides a new base for further learning activities.
Assesment/feedback	The main benefit of this activity lies in the assessment of the argumentation. The instructor needs to comment on both votes after the discussions. This will emphasize several things: that more students initially think the same about problems, that several students choose the same solutions, that argumentation helps and that discussions with peers brings you closer to the correct solution. Mainly this is an in-class activity, which does not sum up to a grade (even if it is possible to score the final answers). Allowing for anonymous answers in the response tools, give students extra motivation for participating, and the learning outcome from the feedback is more useful than a summative grade. Even if the formative part is most useful, the instructor needs to make sure that the final agreement in class is mathematically correct.

Room-structure	One needs a projected screen in the classroom in order to showcase both the results and the solutions if interesting. Otherwise all students must have a device connected to the internet, and ideally one should place groups on round-tables. The collaborative work is designed as an in-class activity, therefore groups need to have a common focal area at the instructors place. The focus will be the problems given, both on the paper and at the projected screen where the instructor is located.
Technical competencies / digital skills	Depending on the amount og digital tools previously been used, and the training in the given tool, the task do not require anything beyond basic digital skills. The students are supposed to open a web browser, connect and deliver two votes in a pre-designed response tool. For the instructor the main competency is connected to the assessment and understanding of the votes provided, not the digital approach itself.
Statistics and theory	Students need access to taxonomy for grading. It I also extremely important that the instructor explains about the session before beginning. It is very useful to collect different arguments from the groups in order to both prepare next class where these can be used, or to foresee what can be the results next time one does the same collaborative work. The key element is the explanation from the instructor in plenary, and this type of statistics can improve the accuracy in this part late on.



Appendix B: Case for High School Education

File name: Best case High School.

Title and short description: Collaborative learning. Using Educational Technology to enhance learning outcomes.

Learning objective/aims	The main aim of the case is to enable students to collaborate with a team online through a dashboard Learning objectives of the work is different features and skills necessary to work collaboratively in a good way. This means to learn how to give feedback online, to learn how to work in teams and to learn how to reflex.
Instructions	The instructor should present how the tool is used, how the contents are presented in the app and the results expected from the students. First, the instructor shares some texts (depending on the group size) about an specific historical time (for example, French Revolution). Texts must be selected intentionally, they should include economic context, cause and consequence, source and at least 2 groups must have the same ones. Secondly, the teacher divides the class in several groups. Each one has a text assigned. They have to read it and identify on the text as much as they can of the following items: Archaeology, historian, historical source, site, timeline, stage, cause, consequence, economics, society, politics, culture… Thirdly, groups are asked about what items have they found in their text and where (highlight the sentence) and send the answers to the teacher. Then, responses are shared with the classmates and teacher introduces the discussion with questions like “Do you think your classmate is right?” “Which do you think it’s the consequence and why?” “Is that a primary source, or a secondary one?” “Why that” and other students share their thoughts about it too. Finally, make a collaborative file (for example Miro’s dashboard) with the concepts learned and one of the text references they found out.
Materials beneficial for collaboration	Shared document – Historical texts Projected screen – Miro’s dashboard

Cases – structure	The instructor should have explained the history concepts beforehand. Then, he proposes this activity where student groups must discuss a reflexive question and then share it with the instructor. Done that, professor could read each group response and ask other groups their opinion about it so that he could create an atmosphere of discussion.
Group size	3-5 taking into account the average class size. However may vary in each case.
Time scale	45-90 min, which is the standard duration of the class.
Instructor role	Involved in the presentation of the tool and explanation of the activity. Involved in previous explanation of historical concepts. Also, he/she needs to make a previous text selection to assure instructions and activity can be followed with success. Monitoring meanwhile the activity is going on. Collecting student's answers. Guide the discussion and monitor the Miro's dashboard.
Facilitation	The students will be able to talk their minds, share their ideas and express their opinions in a comfortable manner and collaborative environment. Ensure participation and collaboration among peers. Give each participant a turn to speak, and later recap on a) what they have understood of these concepts: *historian, historical source, site, timeline, stage, cause, consequence, economics, society, politics, culture*; b) show on screen everything they have said.
Communication	Online among students, ensuring time control by the teacher and adjusting the discussion to the terms intended by the teacher.
Learner roles	We must take into account that there will be students with more interest in the subject than others. We must make sure that everyone participates and that the most active ones do not monopolize the attention.
Pedagogy	Learning through the process Peer- learning Learning by instructions and collaboration Group sharing and discussion

Assessment/ feedback	The evaluation is based on the level of student participation, the richness of the discussion and the response rate in the application. First type of assessment is: peer to peer evaluation since all students share their thoughts about the other one's responses. Second type of assessment: self-assessment, since students must relate a concept with an example on the Miro's board.
Room structure	This is thought to be delivered as a hybrid case. First, concepts are explained at class along with the explanation of the activity and reading of the texts. Then, the online part goes like this: There will be at least 4 online rooms with 3-4 pupils per room. We will need a space in each room to provide the answers and share them with the teacher. Also a space to make a collaborative dashboard (all the class together)
Technical competencies/ digital skills	Instructor: Basic connection experience Participants: Basic connection experience
Statistics and theory	Access to taxonomy for grading. Explanation about the assessment via rubrics from instructor. Teachers assessment in plenary at the end.

Appendix C: Case for Adult Education

File name: Best case Adult Education

Title and short description: Content development. Gaming.

Learning objective/aims	The main aim for the collaborative work in this case is to practice problem solving and decision-making for the students involved, and to do it together as a group. Learning objectives can be dependent on the subject, but might also be generic. In this case the students will learn to analyse, discuss probable outcomes, argue their decisions and make internal strategies in order to perform better as a group.
Instructions	Dependent on the choice of game, but instructions should be available in-game. The instructors needs to inform about time-frame, group dynamics, rules for the game, netiquette and how the assessment will be done. Additionally, in order to succeed, one needs to include specific instructions and rules for the communication internally in the group. One should focus on encouraging active problem solving accompanied by a point system to create a pathway to elevate learners to more complicated tasks reflecting the specialized theoretical content of units. The instructor should focus on the relevance for the working market with the tasks to be performed inside the game.
Materials beneficial for collaboration	The game needs to allow for collaboration. Some internal communication tool, like a chat box, should be available. Additionally one can distribute theoretical documentation for the subject focused in the task. Ideally the game should be displayed live on a projected screen that all students can see, in order to follow the development of the game.
Cases – structure	The structure of the learning activity will be determined by the game and the progress in this.
Group size	In order to involve most students, one should limit the group size to four students.
Time scale	90 minutes.
Instructor role	The instructors main work is being done in the pre-phase of the collaborative work. It is important to be clear in the instructions and to have control over the possible outcomes of the game. The learning aim needs to be clear and clearly communicated to the students before the game begins. Whilst playing, it is necessary to ensure that all students are allowed and enabled to participate and be active in the decision-making all the way. Games can often provide an arena for playfulness, therefore it is vital that the instructor keeps their focus on learning outcome throughout the whole collaborative process. During the game the

Instructor role	instructors need to be a clear facilitator, being the one with most knowledge both about the game itself and the subject at hand.
Facilitation	Implementing games in an educational setting will always be a risk, even if one is involved in Adult Education with mature students and no matter the instructions provided. Thus the facilitation of the collaborative work is the most important in this case. The facilitator needs to be active, strict and follow all groups progress continuously. Depending on the time frame one can allow more or less communication and off-topic gaming. The most important is to facilitate for progress towards the learning objectives, and ensure that the group discuss their choices every time, and make sound common decisions. The facilitator should note all interesting arguments and discussions in order to build a plenary discussion on these. This will enhance the learning outcome from the collaborative work immensely.
Communication	Communication is one of the key elements in this case. The game should facilitate for internal communication via chat or videoconference if online environments. Additionally the instructions need to include specific rules for the communication, how to behave to each other and turn-taking. In order to achieve the aims for the collaborative work all students need to be activated, and all students need to be enabled to present their arguments and defend the choices they want to do in different situations. This needs to be clear from the start, otherwise the group leader will be responsible and in charge of everything being done.
Learner roles	It is necessary to have a group leader, somebody who performs the moves or decision in-game. Outside this role, no specific roles are required.
Pedagogy	This case is a classic example of game-based learning, which can be orientated towards both learning new skills, practicing and reinforcing skills and/or develop learning and innovative skills. The pedagogy applied should focus on socio-cultural aspects , and involve an active approach from all the involved participants. The approach needs to balance the earning aims with the playfulness, and allow for both. Otherwise it is a chance that the collaborative work resembles a text book, or drifts on into a pura entertainment.
Assessment/ feedback	There is always a clear degree of summative assessment in a gamification of content. Someone will achieve higher scores then others, and this needs to be recognized. Still it is important to focus on the internal communication in the group, the ability to argue for a view and convince the other members about your strategy and the ability each group member have to recognize all members opinions. This should be the focus of the summary more then who won the game.

Room structure	Ideally all students should be placed in the same room, with a common screen to follow the process. Members of one group can be placed close to each other, but this might not be ideal depending on the choice of communicative channels. In a collaborative work like this there might be a lot of noise due to micro-communication, and restricting the ability to utter arguments orally might mitigate this.
Technical competencies/ digital skills	Including game-based learning requires a quite high degree of digital skills, depending on the complicity of the game itself. The instructor needs to inherit high skills, and the students needs to be able to utilize all functionalities in the game. The more time provided for the task, the less important is the digital skills.
Statistics and theory	Note down all interesting arguments and discussions. Keep these for improvement of future development of the subject content.

Appendix D: Case for VET

File name: Best case VET.

Title and short description: English. Subject-verb agreement

Learning design/aims	The main aim of the activity is to work collaboratively on fixing mistakes and creating new texts based on the new dynamics of the texts. As an extra feature the case will encourage teamwork and collaboration also on grammar issues. The learning objective in this case is related to subject-verb-agreement, one of the most common mistakes done by FL-learners of English.
Instructions	The session starts off with a theoretical part in plenary, before the students are randomly divided into groups. Students are given access to a shared document, where they all will work together in synchronous time. The students are asked to firstly do the exercises provided, and agree upon the correct solutions. Secondly they are to identify the errors in the provided text, and correct these. In this part they need to explain why the identifies passage includes an error using theory. At last they are asked to rewrite the text, grammatically correct and with a better dynamic.
Materials beneficial for collaboration	Shared document including both theoretical explanations for subject-verb agreement, exercises and a text with some common errors.
Cases – structure	Important to make sure that the exercises both include some obvious mistakes and some difficult to spot examples. The exercises should provide an entry for the weaker students, and give some challenge to the stronger students. The theory provided needs to be applicable in order for the stronger students to explain the mistakes for the rest of the group. The text included could preferably be translated in a bad way. (try https://lingojam.com/BadTranslator for example), to ensure that the students will be able to improve it.
Group size	Depending on the size of your plenary group, use groups of 3 or 5. Important to have unequal numbers to create discussions on alternatives in the exercises. Some periods in plenary.
Time frame	90 minutes

Instructor role	Important to make a short introductory plenary and present the theory on subject-verb agreement in the beginning. If necessary, for example if several groups are struggling on the same exercise, use some minutes to explain in plenary before continuing the collaborative work. During the work the instructor should be monitoring without interfering, allowing the groups to aid themselves.
Facilitation	The most important to facilitate is that the stronger students allows the weaker ones to try. At the same time the facilitator should urge the strong students to use their inherent knowledge to improve the skills for all group members.
Communication	Depending on the location of the students, f2f or online, the communication will be different. In a classroom one should allow for oral discussions, whilst online one could implement a chat channel or ask the students to use notes in the shared document if applicable. It is vital for the progress to make some rules for the communication, otherwise some students will not be heard.
Learner roles	Important to remember that there will be students better than others in arguing their case. In this case the most important role will be the leader, that both should monitor time and control the turn-taking.
Pedagogy	The main pedagogy applied in this case is peer instruction, even if the instructor needs to be hands-on the whole time frame. As in most collaborative work the case will encourage active learning, and by limiting the group size all students will be forced to participate in an active way.
Assessment/ feedback	There is no need for assessing the results, neither on the exercises nor on the final text. Instead the instructor should do several short plenary sessions, commenting on what has been done, and how to improve. This is especially important when writing the text.
Room structure	Computer, internet connection, round tables. In-class or online teaching. The focus will be the documents on the shared screen in the tool of choice. If online environment, urge the students to keep their camera on at all times.
Technical competencies/ digital skills	Basic skills. Accessing the internet, connecting via chat and handling easy scrolling, writing, editing and using nots in a shared document.
Statistics and theory	Students should be allowed access to curricular books and other articles. Internet is an obvious choice.