CHARM-EU (CHALLENGE-DRIVEN, ACCESSIBLE, RESEARCH-BASED AND MOBILE EUROPEAN UNIVERSITY)

DELIVERABLE D4.4— CHARM-EU: VIRTUAL LEARNING ENVIRONMENT (VLE) PLATFORM MVP DESIGN GUIDE

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Contents

Management summary

This document describes the process and considerations made while designing the CHARM-EU Virtual Learning Environment (VLE) and toolbox of educational technology to facilitate technology enhanced learning in the Master's Global Challenges for Sustainability, our first CHARM-EU pilot. We've chosen to include Emerging Technology (deliverable 4.5) and Hybrid Classrooms (no prior identified deliverable but this proven to be a must-have facility too for teaching & learning in CHARM-EU) in this document as well because both are very narrowly intertwined with the VLE. Main subjects of this document are:

- An overview of core principles for the VLE and Educational toolbox for CHARM-EU
- An explanation of the CHARM-EU hybrid VLE model and consideration that made us opt for this model
- An overview of the requirements collected for the Winterschool pilot and an evaluation of the results
- An overview of the requirements collected for phase 1 and 2 of the CHARM-EU master pilot and an evaluation of the results
- Lessons learned and recommendations for future editions of CHARM-EU and other European collaborations (e.g. European Universities Initiatives)

In general, we conclude that we successfully organized a VLE & Educational Toolbox, emerging technology, and hybrid classrooms for CHARM-EU. Overall, the tools provided proved to be sufficiently useful in the organization of teaching and learning and the delivery of content based on the technology enhanced learning principle of CHARM-EU. Some tools and technology (MS Teams, Hybrid Classrooms, Utrecht2040 game) proved to be very well received by teaching staff and students and others (Scorion E-Portfolio, MS Whiteboard, MS Translator) were useful to a certain degree but have much room for improvement. In future editions it's recommended to realize improvements in those tools or explore which alternative tools might be a better fit for CHARM-EU.

Finally, we identified several lessons learned on the process of designing and supporting the VLE & Toolbox, emerging technology and hybrid classrooms. Based on these learned lessons we have formulated three key advises for future technology experts in CHARM-EU of which the most important are:

- Plan the exploration of technology tools in education as one of the last steps in module design, once learning objectives, content, and teaching and learning activities are defined in more detail. Technology generally (and logically so) comes near last in the module design process most Knowledge Creating Teams (KCTs) go through while developing new modules. While the process of identifying fitting technology, purchasing, checking for compliance, and integrating software in the VLE is very time consuming. Because of this we lacked time to fully explore possible solutions. This offers new opportunities for future editions of the CHARM-EU Master.
- Ensure a clear plan for identity and access management from the start. Work on interoperability and re-useability of systems already in place at each institution. A single CHARM-EU Identity or interoperability between partner university identities and IT landscape proved to be to challenging for this pilot but is a major improvement for future collaborations between European Universities.

- Organize budget and resources for future editions of CHARM-EU educational programmes. We stress the importance of finding a solution for acquiring long-term technology and technology support staff for future editions of CHARM-EU. During this project all participating universities had to deal with the COVID pandemic which put a lot of stress on technical support making it even more difficult to organize this.

1. The process of developing the CHARM-EU VLE & Educational Toolbox

Development of the CHARM-EU VLE & Toolbox of educational applications was done using a continuous iterative process of collecting requirements, developing solutions, piloting, and evaluation (figure 1). The team in charge of this process is a sub-team part of Work Package 4, Teaching and Learning strategies. Each CHARM-EU partner participated in this team with at least one member since February 2020 until May 2022. Detailed product requirements weren't readily available as CHARM-EU is based on a new concept that kept growing and developing. Piloting the VLE & Tools in the first two phases of the master gave new insights in the pedagogical and technical requirements. Thus, it was important to develop and assemble the VLE and Toolbox using a flexible approach.
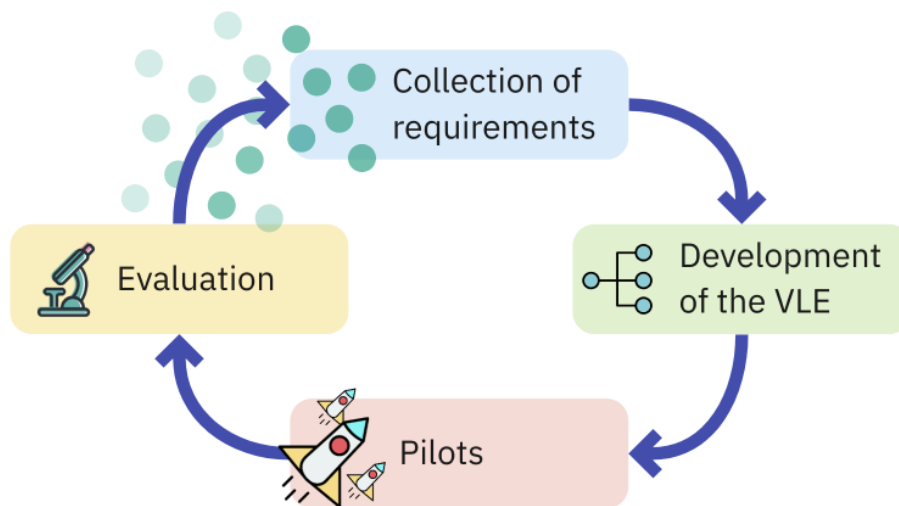

Figure 1: Model of the cycle of VLE & Toolbox development

1. Collection of requirements

The VLE Team included members of each CHARM-EU partner who met every 2 weeks to work on the design of the VLE. Experiences from each partners home VLE were used to design the conceptual CHARM-EU VLE. This design was used as a starting point to gather input from academic teachers and educationalists in workshop sessions and one-on-one meetings. As KCTs (including academic teachers) built their modules for CHARM-EU, over time it became increasingly clear what requirements they had for the VLE & Toolbox.

2. Development of the VLE & Toolbox

Based on the requirements gathered in step 1 the VLE team continuously worked on development of the VLE & Technology Toolbox. Results from this are for instance the development and improvement of the CHARM-EU Moodle look & feel, improvements made in the dashboards of the Scorion E-portfolio and the implementation of WooClap.

3. Pilots

The pilots during the Winterschool and the Master's programme gave the VLE team valuable information on the performance of the VLE & Technology Toolbox in real life education.

4. Evaluation

Teacher and student surveys and interviews were conducted by Work Package 7 to identify strong and weak points and were used as input to form new requirements and start the development cycle over again.

To align with the end of the project in October 2022, it will only provide the results of two full cycles of this model and one partial cycle. We recommend completing the last cycle and using the results in preparation and improvements for future editions of CHARM-EU.

Cycle	Date	Piloted and evaluated in	Results included in this document
1	01-02-2020 – 01-01-2021	Winterschool	Yes
2	01-02-2021 – 01-02-2022	Pre-Master & Master phase 1	Yes
3	01-02-2022 – 01-09-2022	Master phase 2	Partially
4	01-09-2022 – 01-02-2023	Master phase 3	No

2. Establishing the high-level vision and model of the CHARM-EU VLE and Toolbox

In preparation of cycle 1 the deliverable team was formed containing expert stakeholders from all the different CHARM-EU partner universities. The first goal of this team was to agree on a high-level vision and core requirements of the CHARM-EU VLE and toolbox. To do this we've gathered representatives from the partner universities in a workshop setting at Trinity College Dublin at the 26th and 27th of February 2020. During this brainstorm a draft version of the Educational Principles was used to gather core requirements for the CHARM-EU platform. Using these requirements the deliverable team created a first draft of the CHARM-EU vision on the VLE & Toolbox.

The CHARM-EU Vision on the VLE

The CHARM-EU VLE is a digital ecosystem consisting of various educational tools and services that work seamlessly together to support students and lecturers in their educational activities. CHARM-EU adopts the Educause definition of the NGDLE:

*"The next generation digital learning environment (NGDLE) is conceived as an ecosystem—a learning environment consisting of learning tools and components that adhere to common standards. (*Educause, 2016)

Core requirements of the CHARM-EU VLE

The VLE and Technology Toolbox facilitate teaching and learning by supporting the

Educational principles[1], Programme Learning Outcomes[2] and Pedagogical Guidelines[3], and thus it should facilitate both online, blended and hybrid education. Next to that is a set of core requirements that the expert group and different partner stakeholders found important:

- **Sustainability.** In relation to the Educational principles we value sustainability. In terms of the VLE this translates to finding out which components of the VLE we already have and which ones we might be able to re-use / recycle with low costs involved.

- **Security.** The VLE is secure and can safely be used by students and academic teachers. The VLE and Toolbox comply to a set of security requirements set by the institution that facilitates the software (mostly Utrecht University).

- **Privacy.** We respect our students and academic teachers' privacy. The VLE complies with the most current EU privacy laws (GDPR).

- **Open Source.** In relation to sustainability, we value open-source software. This makes the VLE less dependent on commercial tech companies and makes it easier for other European Universities to copy our model. It is very well possible that certain components of the VLE can't be solved with open-source software. In that case we will consider using commercial closed source software but only based on criteria that make sure that our data is secure and preventing possible vendor lock-in.

- **An ecosystem of flexible and adaptable tools.** The VLE consists of a variety of tools and services that are interoperable with one another. This means that it is clear which tools and services are available for each educational function, as well as the tools' specific characteristics (benefits and disadvantages). It also means that they can exchange data when necessary, and the access to the tools is well-organised. This must be flexible and easily adaptable to the needs and preferences of the users (students and academic teachers) and based on new insights gained from educational research or new technological possibilities.

- **User-friendly and digitally accessible.** The VLE has an intuitive user-interface and is user configurable where necessary. We aim for digital accessibility by design of both the VLE and the Educational Toolbox.

Components of the virtual learning environment & Educational Toolbox

The next step was to identify the components of the VLE and the Toolbox. For this we used a modular functional model created by several Dutch universities together with SURF (a Dutch national research and education network similar to HEAnet in Ireland, NIIFI in Hungary, RedIRIS in Spain and RENATER in France). This model differentiates between the following 12 components listed in table 1. The VLE should support the educational principles of CHARM-EU. The impact of these principles on

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[1] https://www.charm-eu.eu/toolkit/charm-eu-educational-principles-practical-tips-knowledge-creating-teams
[2] https://www.charm-eu.eu/toolkit/charm-eu-educational-principles
[3] https://www.charm-eu.eu/toolkit/charm-eu-pedagogical-guidelines

the VLE has been inventoried in the February workshop meeting in Dublin and can be found in appendix 1.

Table 1: Components of the virtual learning environment taken and adapted from SURF[4]

Component	Description
Communication	Functionality that facilitates a variety of forms of communication. E.g. Internal communication among teachers and students and external communication.
Collaboration	Functionality that facilitates a variety of forms of collaboration. E.g. internal collaboration and external collaboration.
Organisation of learning	Functionality that ensures students have access to the proper content and applications necessary for learning. This includes functions such as assigning students to groups, assigning (groups of) students to courses, and arranging access management.
Assessment	Functionality to support a variety of formative and summative assessment methods supportive of the assessment plan.[5]
Internship and graduation	Functionality for evaluating the match between the capstone assignment, the capstone organisation, and the student. Also for the management of contracts and documents, monitoring progress, and relations management.
Submitting and evaluating assignments	Functionality that supports the submitting and evaluation of assignments. This includes functions such as uploading assignments, setting and communicating deadlines, and checking for plagiarism.
Multimedia	Functionality for recording, displaying in real time, playing on demand, editing, storing and managing video material.
Educational process supervision	Functionality for monitoring and supervising students in their learning process, for example by providing feedback.
Managing and using student information	Functionality for managing students' administrative data and for registering grades, progress, and attendance.
Scheduling	Functionality for the best possible allocation of hours and resources among lecturers and students.
Developing, managing and sharing learning materials	Functionality for developing, managing and sharing learning materials.
Learning analytics	Functionality for collecting and analysing information about the students' learning process, with the aim of understanding and improving the education and the learning process.

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[4] Dompseler, H., Ham, R. & Wit, de, M. (2016). *Een flexibele en persoonlijke leeromgeving. Een modulair functioneel model*. SURFnet. https://www.surf.nl/kennisbank/2016/notitie-flexibele-en-persoonlijke-leeromgeving-een-modulair-functioneel-model.html

[5] https://www.charm-eu.eu/toolkit/masterclass-charm-eu-assessment

Different models to compose the VLE

We identify two fundamentally different models to compose the VLE. The all-in-one model and the best-of-breed model[6]. The pros and cons of each model are listed below and we suggest a new model for the composition of the CHARM-EU VLE.

The all-in-one model

In this model the Learning Management System (LMS) is the vital educational tool of the VLE. The LMS, like for instance Blackboard, Canvas or Moodle, is used for nearly every component of the VLE list in table 1. Additional tooling is only considered if the LMS doesn't offer similar functionalities. This model has different pros and cons:

Pros of the all-in-one model
- Offers a more uniform and seamless user experience: Because the all-in-one model uses one main platform for a lot of different functionalities the look & feel, terminology and lay-out are very similar throughout the whole platform.
- Is easier to manage and administrate: Technical support staff and administrators only have one main system to support. This means that there's generally only one vendor to communicate with or one system to host and keep up-to-date. This usually makes it easier and cheaper to keep the system stable and up-to-date.

Cons of the all-in-one model
- While offering a lot of different functionalities these functionalities are sometimes very limited compared to dedicated tooling. This is sometimes compared to a Swiss army knife, it offers a lot of different tools but the tools are also very limited.
- It offers little room for innovation and experimentation: Users are limited to what's available within the LMS and usually have little to no access to external tooling.

The best-of-breed model

In this model the best available tool for each VLE component is selected on the market and is integrated as well as possible within the VLE landscape. Usually an LMS is only used for the organization of learning and to make 3rd party tooling accessible to users. This model is often referred to as a 'personal learning environment'.

Pros of the best-of-breed model
- Offers a lot of freedom in terms of customization of (parts of) the VLE and selecting the tooling that adheres most to the needs and wishes of the users.
- Offers a lot of room for innovation and experimentation: New market solutions can be adopted quickly.

Cons of the best-of-breed model
- Offers a less seamless and uniform user experience: Because tooling from different suppliers are used look & feel, terminology and lay-out might vary a lot between different components of the VLE. Current educational standards don't allow for visual integrations.

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[6] https://er.educause.edu/articles/2017/6/integrating-data-and-systems-to-support-next-generation-enterprise-it

- Interoperability is often limited. E.g. grades / results from activity in a best-of-breed tool might be difficult to record in the LMS student record.
- Web based tools can often be based in different geographical and legislative regions, thus complicating GDPR compliance.
- Harder to manage and support: IT architecture gets more complex when using different tools from different suppliers. Technical support staff will have to learn to work with different applications and communicate with different vendors when troubleshooting.

VLE model analysis

If we score the different models based on the core requirements for the CHARM-EU VLE we see that both models have their strengths and weaknesses (table 2). Thus we suggest creating a hybrid model combining the strenghs of both models and of which a proposition is done on page 8.

Table 2: Scoring the VLE models based on the CHARM-EU Core requirements

Core requirement	All-in-One	Best-of-Breed
Supporting of the CHARM-EU educational principles, programme learning outcomes and pedagogical guidelines	- Not much flexibility: have to use what's available within the all-in-one	+ More flexible to support tools with very specific functionality
Sustainability. In relation to the Educational principles we value sustainability. In terms of the VLE this translates to finding out which components of the VLE we already have and which ones we might be able to re-use / recycle with low costs involved	- Might be possible to re-use a complete all-in-one system but seems unlikely	+ More flexible to re-use individual tools
Security**.** The VLE is secure and can safely be used by students and academic teachers. The VLE and Toolbox comply to a set of security requirements set by the IT Expert group.	+ Easier to check and secure one system than an ecosystem of different tools	- Takes more effort to check and secure an ecosystem of different tools, it's more complex.
Privacy. We respect our students and academic teachers privacy. The VLE complies with the most current EU privacy laws (GDPR).	Easier to make GDPR agreements with one party. However might severely limit the choice if suppliers can't comply.	Takes more effort to make GDPR agreements with multiple suppliers. Does offer more flexible to pick compliant suppliers.
Open Source. In relation to sustainability we value open source software. This makes the VLE less dependent on commercial tech companies and makes it easier for other European universities to copy our model.	- Very limited in possibilities. Moodle seems like only viable candidate	+ More flexibility and thus more options to pick useful open-source tooling
An ecosystem of flexible and adaptable tools.	-- Limited to tools within the all-in-one system	++ Lot's of options and possibilities of different tools
Digitally accessible	+/- Just one system to check on digital accessibility. However hard to replace parts / tooling that aren't accessible	+/- More effort to check ecosystem of tools for digital accessibility but does offer freedom to replace parts that aren't accessible
User-friendly. User-friendly or 'usability' can be assessed based on the following critiera: [7]		

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[7] Usability 101: Introduction to Usability Archived 2011-04-08 at the Wayback Machine, Jakob Nielsen's Alertbox. Retrieved 2010-06-01

A Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	+/- Might provide to many unnecessary options	+/- Different look & feel and terminology might be confusing
B Efficiency: Once users have learned the design, how quickly can they perform tasks?	-	++
C Memorability: When users return to the design after a period of not using it, how easily can they re-establish proficiency?	+/- Design and tools stay mostly consistent	- Tools can be updated or swapped
D Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	++ Very stable with little effort	+/- Requires more effort to create a stable VLE
E Satisfaction: How pleasant is it to use the design?	+/-	+/-

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The CHARM-EU Hybrid VLE Model

The virtual learning environment is an ensemble of all the different components working together where necessary (and possible). The core of the VLE is a platform dedicated to the organisation of learning. A core platform like this offers functionality that ensures students have access to the proper content and applications necessary for learning. This includes functions such as assigning students to groups, assigning (groups of) students to courses, and arranging access management. This functionality is offered by a Learning Management System (LMS) like for instance Moodle, Blackboard or Canvas. The student information system and the open educational resources repository should ideally be connected to this core platform. If other functionalities within the LMS prove to be useful for CHARM-EU education they are used as well. If certain LMS functionalities prove to be too limited, we will select dedicated best-of-breed tools and integrate them with the core LMS. These tools are connected and / or embedded to the core LMS and offer specific functionalities that support the pedagogical guidelines of CHARM-EU. This flexible layer might contain tools for assessment, peer feedback, collaboration, communication, etc. Both the flexible layer and the core platforms should in the future ideally be connected to a learning record store and visualisation engine.

The outside layer of the virtual learning environment offers room for emerging technologies. Often innovative emerging technologies don't offer the required standardisation necessary for interoperability with the other components of the VLE. In this case an exception can be made to use these technologies outside of the core platform. The model below was used through each cycle of development of the VLE & Toolbox.
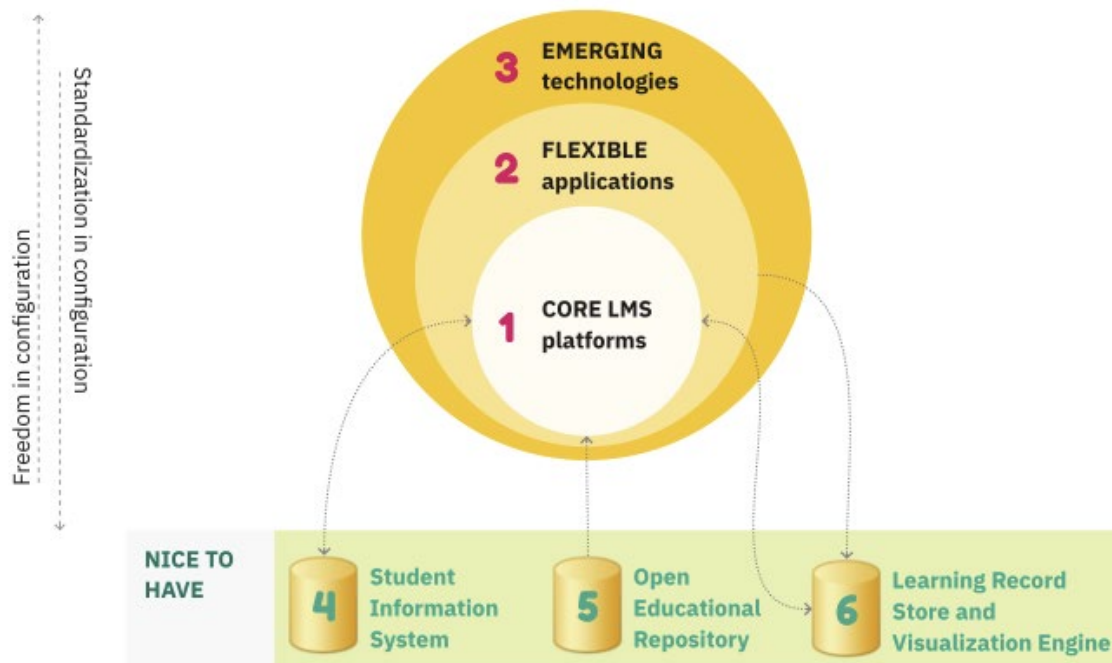

Figure 2: The CHARM-EU VLE Model

3. Cycle 1: The Winter School pilot

Early preparation for the Master's pilot began with a Winter School Pilot in January 2021. This was a student led programme which introduced students to transdisciplinary thinking and innovative research methods that can be applied across and above academic disciplines, including Critical Thinking and Collaboration Skills, Communication Skills, Creativity and innovation skills, Self-direction skills Global and Local connection skills, Using technology as a tool for learning. A full report on the Winter School pilot can be found in the toolkit.

Preparation for the Winter School included requirements identification and the evaluation of VLE and toolkit components. The requirements were gathered through close collaboration between the pilot work package and numerous subgroups of the teaching and learning work package. The following VLE and Toolkit specific requirements were identified:

- The need for a platform to facilitate collaboration and communication between teachers and students.

- A tool to prepare learning resources as a teacher and share learning resources with students. Students should be able to complete learning resources and hand them in to teachers.

- A tool to facilitate community building. The Winter School was completely online, which is why extra attention was given to helping the students to get to know each other.

- A tool to help make the online sessions more interactive with live quizzes and polls.

- A platform to record and share a vlog with teammates.

- A platform to facilitate an online social gathering

Following the requirement identification, early development of the VLE began with the design of the MS Teams environment and our selection of a set of third party "flexible apps" for learning activities, including, IceBreaker.video (1-to-1 video chatting), WooClap (polls), FlipGrid (social vlogging) and Mozilla hubs (mixed reality environment). These pilot elements of the CHARM-EU VLE were then tested with students during the 5-day Winter School programme. The technology workpackage liaised with the pilot work package to develop a set of questions relating to the VLE, and students were surveyed both before and after the programme. Full details of the feedback can be found here in the Winter School Report.

4. Cycle 2: Master phase 1

After the Winter School pilot, the VLE-team continued engaging with the Knowledge Creation Teams to gather requirements for the VLE and in particular for phase 1 of the Master pilot. Both workshops[8] and 1-on-1 consults were organized to gather requirements.
To summarize the following VLE and Toolkit specific requirements were identified:

Core-platforms
Platforms that each module would use intensively to deliver their content and organize teaching & learning.

- The need for a platform to facilitate collaboration and communication between teachers and students.
- A platform to prepare learning resources as a teacher and share learning resources with students. A platform to organize modules and content.
- An e-porfolio to facilitate programmatic assessment

Flexible applications
Applications that would be used in some modules to deliver content and organize teaching and learning but not intensively by all modules.

- A tool to help make the online sessions more interactive with live quizzes and polls
- An online interactive whiteboard tool for brainstorming purposes

Emerging Technologies
Numerous tools were proposed by the Emerging Technology team to the content teams to help address the digital skills requirement in their modules. While most of these tools were not ultimately integrated into the programme, one serious game ("Utrecht 2040") was used to great success and this is discussed below in the development of the VLE Toolbox section.

Hybrid Classrooms
During the preparations for phase 1 we soon realized that hybrid classrooms at each campus would be necessary for the delivery of the Master's. This posed a new challenge as at that point in time only UU had these classrooms on campus. On initiative of the VLE and emerging technologies team a new sub-team was formed in charge of realizing one hybrid classroom at each campus for CHARM-EU and aligning those classrooms in terms of lay-out, design and hardware.

Development of the VLE & Toolbox
Following the requirement identification the following applications were chosen to form the VLE & Toolbox for semester 1:

A) MS Teams to facilitate collaboration and communication. With the good experiences from the Winter School Pilot MS Teams was an obvious choice to use again in the Master Pilot. We used 1 MS Teams environment for all modules in phase 1.
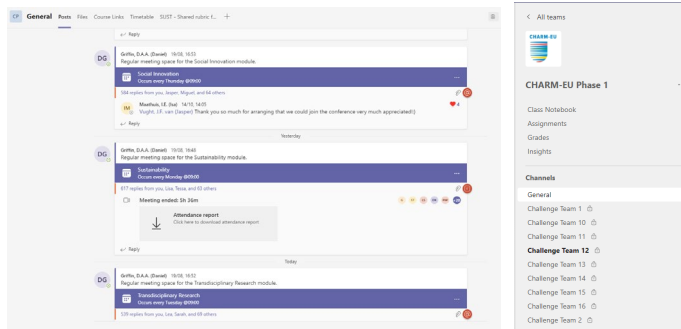
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[8] https://www.charm-eu.eu/toolkit/technology-enhanced-learning-workshop

Figure 3. Three MS Teams meeting spaces

B) Moodle to organize modules and content and deliver learning materials and associated resources. Moodle is a platform where teachers can create an online learning environment for students. This means that course materials (e.g. lecture notes, presentations, videos, resources), learning activities (e.g. forums, quizzes, glossaries, wikis) and interactive activities (e.g. drag and drop, interactive videos, interactive presentations) are all in one place for students to access. Four out of five partner institutions already had good experiences with Moodle. Most members of the KCTs were already familiar with it as well which made Moodle a logical choice to use.
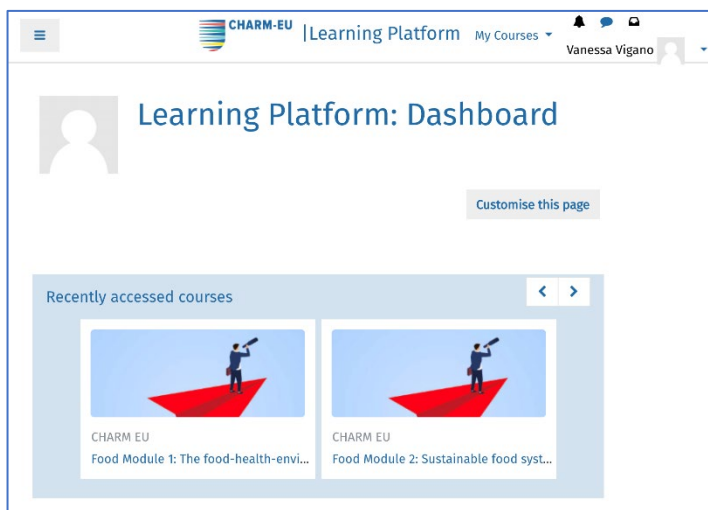

Figure 4. The homepage of CHARM-EU Moodle installation, students can easily find modules and contents uploaded by KCTs

C) Scorion as the portfolio to facilitate programmatic assessment. The VLE-team compared three portfolio systems (Mahara, Scorion and ePass) based on the requirements set by the assessment team Scorion came out ahead in our comparison, primarily based on the elaborate possibilities of visualizing student progress on the dashboard.
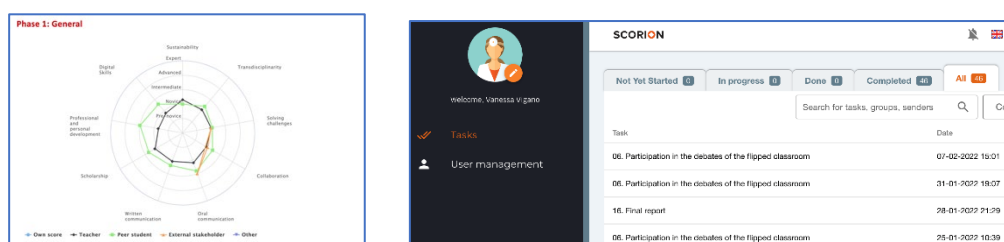

Figure 5. Scorion Dashboard and report

D) WooClap to make online sessions more interactive with quizzes and polls.
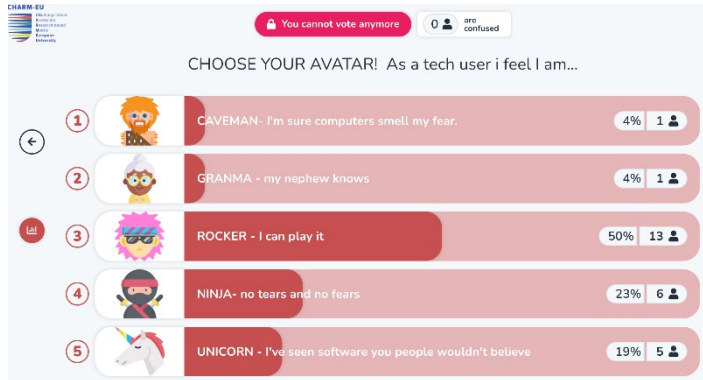

Figure 6. WooClap

E) MS Whiteboard was used for brainstorming purposes. The tool <u>Miro</u> proved to be a better fit in terms of functionality and performance but wasn't GDPR compliant and thus we advised KCTs not to use this tool.
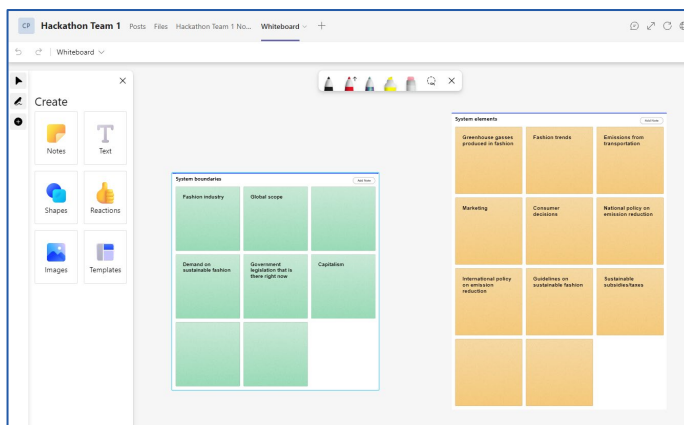

Figure 7. A learning activity using MS Whiteboard

F) Utrecht2040 game
The Utrecht 2040 game was used during phase 1 orientation week, where students were tasked with using the app to visit some locations in their city and learn about sustainability issues. This activity primed students by introducing content topics, and it had the added benefit of ice-breaking for the newly arrived students. Students posted photos from their activities and these were shared with the plenary group later on in an MS Teams session where they formed the basis of some interesting discussions. Student feedback was very positive and they clearly enjoyed the activity.
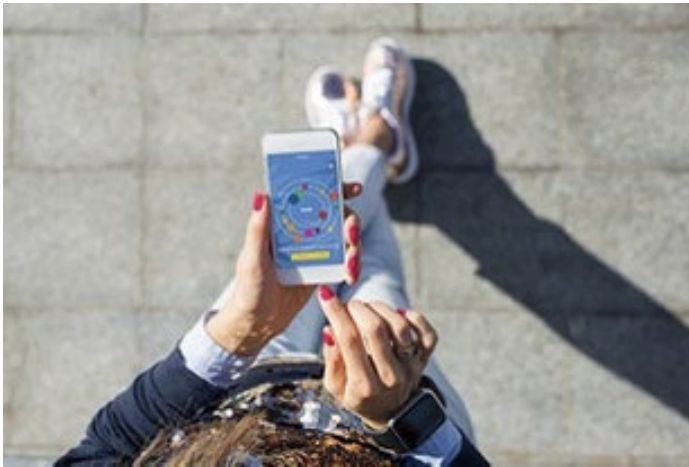
Figure 8. Utrecht 2040 app in use

G) Hybrid Classrooms

Because the design and creation of hybrid classrooms on each partners campus required different expertise, a sub-team was formed for this task. The considerations made while designing the hybrid classrooms for CHARM-EU can be found in the Hybrid Classrooms Handbook: https://www.charm-eu.eu/toolkit/hybrid-classroom-handbook
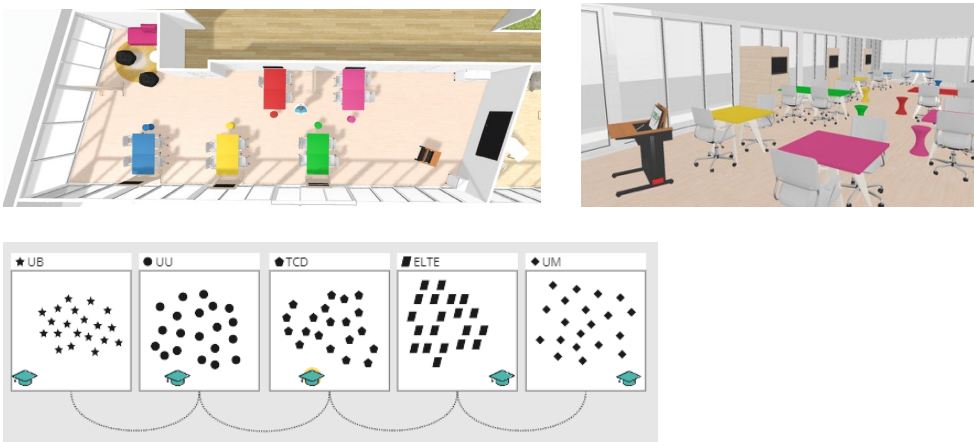

Figure 9. Hybrid Classroom are equally equipped, pods allow local groupwork. A teaching assistant is present in the classroom to facilitate the activity

Evaluation of the VLE & toolbox Phase 1

Evaluation of the VLE & Technology Toolkit by survey questions were part of the phase evaluation of Work Package 7. A full report on the evaluation can be found in the toolkit. In addition, both formal and informal feedback by academic teachers, students and support staff was used to evaluate the VLE & Toolbox in phase 1 and a second survey focused solely on the VLE, emerging technology and hybrid classrooms was conducted among teaching staff. This group included the module coordinators and teaching assistants. Twenty-four questions were asked via Microsoft Forms and an average of nine responses were received per question. The questions focused on the core applications (Teams, Moodle, Scorion), experience with the hybrid classroom, and a question to identify future training needs.

Results of the staff survey

Core Platforms

All respondents disclosed that they had good prior experience with Microsoft (MS) Teams, and this is unsurprising given that each CHARM-EU partner already uses Teams as its collaboration platform. One third of the respondents (n=3) stated that they needed a small amount of help with some MS Teams features. Teams is also the official collaboration platform of the masters, and we were especially interested to learn that there was a split amongst staff in feeling that MS Teams met their communication needs (Yes=5, no=4). This may be due to issues with the other core apps, since most (n=8) reported that they felt there was some redundancy between MS Teams and Moodle. Staff also observed this confusion within the student cohort.

- *"Some materials were posted in a random way and students were confused at times as for where to find what"*
- *"All teaching materials can be stored on MS Teams. Personally, I only used Moodle to send announcements to students"*
- *"it seemed that everything could be done with just one platform"*

Moodle was not used as much as the VLE team expected, except for the forum notification feature, which was well received. This resulted in some miscommunication and confusion among students, which the staff highlighted in their responses. We think the reason Moodle wasn't used as much as expected was mainly due to time constraints by the KCTs. Not all of them seemed to have time to dive into the deeper functionalities and possibilities that Moodle has to offer.

- *"Not a bad implementation, but as I did not use any advance features such as quizzes or feedback fruits it didn't really add much to the learning experiences"*
- *"Moodle was under-used. We ignored many of it's best features and used it primarily as a content repository, and for one-to-many broadcasts. The forum announcements were used well but conversations were often split, or moved over to Teams, resulting in confusion for students about which information was the more current."*
- *"Moodle is not an essential platform in my view. All useful info (e.g., teaching schedule, teaching materials) can be stored on MS Teams. It requires a lot of extra work also to design your course on Moodle. I feel that this work is not required if we decide to only use MS Teams, and to send out announcements through an email listserv."*

The overall impressions of Scorion were mixed. All respondents agreed that they needed some level of support to use the platform. Regarding assessment needs, two respondents stated that they were satisfied that Scorion met their needs, whereas six stated that it was insufficient. One participant was unsure. There was a general sentiment that the platform was difficult to work with as it suffers from numerous short-comings and will require significant effort and rework to resolve.

- *"The 'happy path' to complete an action works well, but there is nothing obvious about the process and students took several weeks to become comfortable with even the most simple of actions. Any deviation from the basic functionality causes*

problems. The application is extremely inflexible and it requires the additional operational costs of VLE Support staff to regularly correct problems."

- *"Not useful for group work (need to put in feedback per individual student). And not flexible (could not add new forms half way through; opening up forms again was a pain and required additional support)."*
- *"Although the overall idea of using Scorion for general assessment have positive aspects, it is not the best tool for in terms of practical and straightforward evaluation of the learning progress."*

Hybrid Classroom

Some extremely positive feedback was received regarding the hybrid classroom setup. Most (n=8) respondents agreed that the space covered all of their teaching needs, with one (n=1) being unsure. Audio issues were the only criticism and this was anticipated since it was an area that the support teams addressed during phase one. Pods were not used as much as they could have been and this was identified in the response data.

- *"Overall quite good, some issues with sound of trains, but once a process was implemented, this was largely resolved"*
- *"Good! We might improve the use of pods by students accordingly to teaching staff"*

It is interesting to note that most staff (n=7) stated that they felt confident to conduct a session without teaching assistant support, with a small number (n=2) being unsure. We are surprised by this response, given that teaching assistants invariably made last minute adjustments to deal with issues before they arose, and this was sometimes not obvious to academic teachers who were engaged in their content delivery. Further enquiry and analysis are recommended.

Future improvements and needs

Most respondents (n=8) agreed that a dedicated VLE onboarding session would be a useful support. One respondent was unsure. Open ended responses to the training needs question also confirmed that this would be appreciated. Suggestions for improvements were gratefully received and included some interesting suggestions that we feel are actionable. These included:

- A module coordinator dashboard for Scorion
- A dedicated orientation day for new staff
- The use of MS Teams Rooms accounts to replace the teaching assistant logins on the main screen.
- Clearer delineation between roles (for example, where teaching assistants need to help with grading overload)

Lessons learned from phase 1

In summary we conclude that:

1. The applications used generally functioned as we expected and were reliable.

2. Even though we offered professional development to teachers and an induction to students we noticed that it takes some time getting accustomed to some of the applications.
3. Most issues and problems encountered lead back to log-in and authorization problems. For instance, at each institution academic teachers use MS-Teams with an institutional instance. For CHARM-EU they all had to use the UU instance of MS-Teams with the Solis-ID instead of their 'home' university ID. For academic teachers that teach both courses at their home university and a module in CHARM-EU this required a lot of switching between institutions and logging-in and -out.
4. The time between the VLE-support team getting the information required to provide all students and teachers with the necessary access and accounts and the start of phase 1 was extremely short (1 week). This put tremendous work-load on the support staff that during that time was also responsible for completion of the assessment platform and delivering workshops and 1-on-1 support to both students and teachers.
5. The assessment platform mainly had quite a steep learning curve for both teachers and students. We suspect the reasons for this are threefold:
   o Programmatic assessment was a new way of assessing for nearly everyone involved. Everyone needed to get some time to get accustomed to this new workflow.
   o Users found that the E-portfolio wasn't very intuitive and user-friendly.
   o Some last-minute changes were made in the forms used in the platform. This resulted in different descriptions on how to attach files to forms which mainly caused confusion for students. Once identified this was quickly solved.
6. The E-portfolio requires careful preparation in advance since it doesn't offer much flexibility in making changes to forms once students have already loaded them in their own portfolio. During the first phase some changes to forms were requested by teachers but we weren't able to make all of them.
7. It turned out that MS-Teams was not only used for communication and collaboration but also for organizing teaching & learning. This meant that many features of Moodle were obsolete and most students didn't really use it much. Lecturers still replied on Moodle forum posts to make announcements (with the benefit that notices were also sent via email to the enrolled students).
8. The first-time using MS-Whiteboard there were performance issues. Probably due to the whole cohort collaborating on one board at the same time. Some students thought it was caused by performance issues with their own computer but after investigation it was more likely caused by the MS-Whiteboard app. A lesson learned for the VLE-team was to stress test these tools in advance if possible.

These evaluations allowed us to develop a tentative list of requirements for the phase 2 version of the VLE, which we describe as pedagogical and functional / technical / operational.

5. Cycle 3: Master phase 2

After the preparations for phase 1, the VLE-team continued engaging with the Knowledge Creation Teams to gather requirements for the VLE and in particular for phase 2 of the Master pilot. Both workshops[9], 1-on-1 consults, and a hackathon were organized to gather requirements. To keep the VLE consistent for the whole master it was decided to not make

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[9] https://www.charm-eu.eu/toolkit/technology-enhanced-learning-workshop

major changes to the core-platforms and flexible tools. The teachers and students in phase 2 and 3 had the same VLE & Tools to their disposal as they had in phase 1 except that certain tools were added based on the following requirements:

- Organizing interactive field trips routes where questions and extra information can be offered through a mobile device while on location of the fieldtrip.
  For this we piloted the Peek.app and organized 1 field trip at each partner University. In Dublin (Water track) all students of the track were involved simultaneously. The 4 other institutions participated in the food track fieldtrip: each location organized at least 1 field trip in the surroundings using the Peek app.
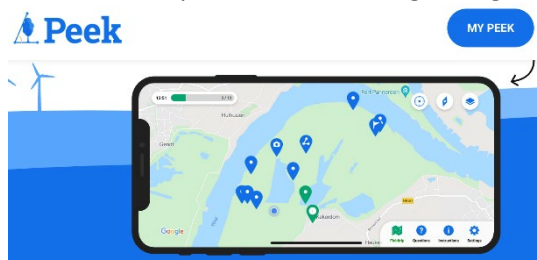

Figure 10. Peek app to provide Geo localized experiences and off-site activities

- Live translation to allow participations (and lectures) of non-English speaker experts. For this Microsoft live translator was used: https://www.microsoft.com/fr-fr/translator/education/ . The live translation was shown via a shared screen.
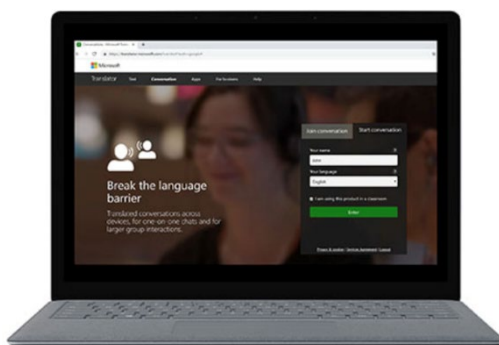

Figure 11. Microsoft live translator, can be used to provide on demand translations.

Evaluation of the VLE & toolkit in phase 2

Because phase 2 is only halfway completed at the time of writing this report a full survey as was done for phase 1 can't be conducted yet. Instead, only informal feedback by academic teachers, students and support staff was used to evaluate phase 2 partially for this report.

1. **Scorion and setup of programmatic assessment**
   In phase 2 we split the design of the forms for programmatic assessment in three batches of 6 weeks. This gave teachers more flexibility in the design of the forms. This was received considerably better than the 'all-in-one-go' approach.

2. **Dublin peek app experience**
   4 april 2022 Dublin city, Water track
   A walking tour of the city looking at a number of sights to gain a historical perspective on how Dublin developed as a city and its water infrastructure changed alongside.
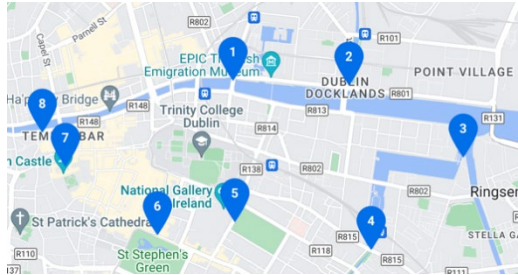
Figure 12. A screen shot of Dublin Peek app experience

Even though the fieldtrip pilot is not complete (we have 4 upcoming field trips on the food track while writing this report) it seems that the implementation of the peek app is pretty easy (high usability and intuitiveness of the tool) and appreciated by students. Improvements can be made on scalability and the possibility to re-use some field trips in the next cohort.

3. **Live translator**
   The translator used wasn't the right tool: it blocked when too many participants were connected to the MS Teams call and translation on specific topic with specialized wording generated wrong translations.

6. General lessons learned and recommendations for the future of CHARM-EU

Within one university with different faculties and disciplines, it is already very difficult to arrange all the arrangements for online education. For CHARM-EU it was even more difficult to get organized and figure out what it takes to meet the needs of CHARM-EU education. Because CHARM-EU is working on a very innovative didactic concept, it was not easy to gain understanding and commitment. Nevertheless, we managed to write down our vision on IT-related topics in support of the CHARM-EU education principles and were able to achieve an understanding from all partners and get commitment from all CHARM-EU partners. And all partners have been working hard to provide the master's technical support and to find local solutions

A Microsoft Form was shared with key stakeholders involved in the VLE development to ascertain challenges faced, recommendations for VLE implementation, and lessons learned in November 2021. This feedback is useful for other European University Alliances seeking to implement similar VLEs and tools for teaching and learning. Four short open questions were provided to members of Work Package 4 (Teaching and Learning), members of the Hybrid Classroom team, Teaching Fellows/Assistants, and other key stakeholders. Additional comments were shared by students in the Module and Phase survey and the VLE and emerging technology survey of phase 1 of the Master.

Key Challenges and Solutions
- GDPR compliance was a significant hurdle that blocked the use of several proposed educational technology tools. We examined a wide set of similar tools to identify those that offered the same affordances. This allowed us to meet most of the pedagogical needs.
- Trinity College Dublin faced a challenge meeting the inclusivity requirements for a hearing loop in the hybrid classroom. This was due to the fact that the room was not originally envisaged as a teaching space and major works would have been needed to install such a system. Roger Pens (assistive listening device) were offered to any students, staff or visitors who needed them.
- Not having a single integrated and CHARM-EU dedicated platform for all staff and students, or sufficient time to test and debug the platforms used was a challenge. Utrecht University systems were used for the VLE environment. Adapted approaches to work around the limitations of the technologies were used.
- Sign up links for Moodle and Scorion E-Portfolio were confusing for students. Good communication was needed to rectify this from the Joint Virtual Administrative Office (JVAO) and teachers.
- Finding a physical location and hardware requirements for the hybrid classroom in some of the partner institutions. Solutions to sound issues included soundbars, eco panels and bespoke sound solutions.
- There was no uniform policy with respect to privacy, security, and purchases. Each institution used their own policies here.

Recommendations for other European University Alliances
The following recommendations were shared for other European University Alliances seeking to implementing a VLE and/or hybrid classroom.

- **Supporting academic teachers is key** to the successful implementation of a VLE. Helping them to recognize the importance of technology enhanced learning is essential. Some may not be focused on technology for teaching, or have experience of integrating technology into their lectures.
- Aim to be open to the different abilities and interests of teaching staff relative to technology enhanced learning. Some may have little or no experience of delivering educational content using technology.
- Designing and delivering brand new modules takes time and effort from teaching staff, in particular those in transdisciplinary, interinstitutional, Knowledge Creating Teams. Adding technology enhanced learning on top of this development of a new module can be time intensive and a novel methodology for many. Try not to overburden teaching staff with too many innovative tools.
- During the CHARM-EU project we had to deal with time pressure and therefore had to work on several topics in parallel. On the one hand, we started with curriculum design and teaching principles. And at the same time, we worked on teaching and learning strategies, including VLE, technology-enhanced teaching and learning, and programmatic assessment. Because of this, we couldn't follow the ideal process and we had to make compromises and opted for an **iterative process**. During this process, we learned, evaluated, and improved the technical requirements, support, etc. This process generally worked well in the context of CHARM-EU.
- **Allocate budget for resourcing** (e.g. support staff)**, software integration** (including services) **as well as hardware** for hybrid learning spaces.
- **Develop a clear and detailed planning, to prevent simple problems** during VLE implementation.
- **Ensure good communication** is very important between all stakeholders during the design and delivery process. Regular meetings and action points are a must.
- **Allow sufficient time for reviews and corrections** to design and development requirements.
- **Start with clear IT governance** and alignment with users and their requirements.
- **Ensure a clear plan for identity and access management** at the beginning. Work on **interoperability** and **re-useability** of systems already in place at each institution.
- Take special care of **common grounds on privacy, security and purchasing** across alliance institutions.
- **For the hybrid classrooms, use professional equipment.** This is very important in terms of sound quality, and modern computer equipment. Keep in mind that alignment of equipment across institutions is hard because of difference in official (tendered) suppliers of equipment. During the COVID pandemic we experienced extra difficulty in acquiring the right hardware for the hybrid classrooms because there was a huge demand for AV equipment.
- **Consider that some teachers may wish to use educational technology that may not be GDPR compliant** or may not fulfil policy requirements in all institutions. Aim to work with these teachers to find compliant technology with similar properties to support their teaching.
- **Innovative teaching and assessment techniques can require bespoke applications and heavy development**. Consider the technical practicalities of a particular teaching and assessment approach before committing to it.

What could have been done differently

Reflecting on the CHARM-EU approach to designing the VLE, the following responses were shared by stakeholders. A common theme was the lack of time to organize and implement the VLE. Technology generally comes last in the educational design process teachers go through while developing new modules. While the process of identifying, purchasing, checking for compliance, and integrating software in the VLE is time consuming and cannot be done at the last moment.

- A longer preparatory period would have been more beneficial. Delays in securing a space for the hybrid classroom, and communication between KCT requirements and the technology team had an impact on the VLE implementation.
- Additional time for platform testing and technology integration across institutions.
- Better knowledge sharing, dissemination, and the process and governance of technology tools at an earlier stage.
- Stronger integration of an IT User Group at an earlier stage.
- Consideration of identity and access management at an earlier stage.
- Involving more users in testing the VLE.
- Better clarity around hardware requirements.
- Better integration between teaching and learning requirements and hardware requirements.
- Create a more formalized process for the use of teaching technology applications to avoid too many similar but different applications being used by different teachers.

Accessibility & inclusivity

CHARM-EU takes an inclusive approach to removing barriers to learning for all our students. To this end, considerable forethought, planning and collaboration took place across all of our work packages to promote accessibility in the design of the programme. The technology teams worked closely with the Inclusivity team to adopt appropriate standards for software and IT procurement. Universal Design was identified as a key aspiration in the selection of VLE components. Best in class tools were adopted to address this need. Our bespoke Scorion ePortfolio system unfortunately did not meet our expectations in this regard and more work is required to improve on this. However other elements of the VLE meet our expectations well and give us confidence that our students are benefitting from an accessible and inclusive learning experience.

Recommendations for the future

We see several areas for improvement that will be of interests to other alliances or future iterations of CHARM-EU courses.

1. Planning.

It quickly because apparent that a weekly planning meeting was essential for successful programme delivery. During Phase 1, this took the form of an all-hands meeting which included the module facilitators and teaching assistants, plus any guests that would need to join in the upcoming week of activities. Questions of access, timing and other coordination needs were identified and addressed during this session. As phase 2 delivery takes a fragmented approach, each theme runs their own theme-specific coordination meeting during the current semester.

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2. Operational.

The importance of teaching and technology support cannot be overstated when considering the operational needs of running the masters programme. Some lecturers have very little exposure to technology and despite the initial training and ongoing professional development, additional on-site support is essential to smoothly conduct a hybrid session. Teaching assistants reported that there are frequently unexpected last minute access issues such as individual lecturers mistakenly logging in as guests or neglecting to activate their SOLIS-ID to access the platform in time. Audio problems are common at the start of class and some adjustments are typically needed to minimise noise and make the best use of the technology.

3. Agreements.

A common approach to the design and creation of the hybrid spaces was seen as a key element in the successful delivery of hybrid learning activities. For the most part this has been successful, however some minor differences were inevitable at each campus, given the need to engage with local suppliers for the setup in each country. A more rigorous set of technology standards may be helpful here to ensure that local suppliers understand the proposed requirements. A pragmatic approach is required however, given the scope of such an undertaking.

4. IT Framework & Governance.

Building on the previous item, a dedicated CHARM-EU IT Framework will be a necessary next step before scaling the IT solution further. The current implementation relies heavily on the Utrecht University IT systems, meaning that the bulk of administration and support falls to UU IT. Work has begun via the newly created Work Package 2.6, which will focus on a federated Identity management system that can enable granular access for students to specific IT systems in each of the alliance member universities. CHARM-EU governance on IT is crucial in this to determine to what extend interoperability between systems of each partner university is desired and achievable. Note that the VLE, while composed of multiple tools and platforms, is just a small part of the whole landscape of IT required to run a master (or university).

5. Budget and resources for future editions.

We stress the importance of finding a solution for acquiring long-term support staff for CHARM-EU. We believe the plans for a 2nd cohort and the ambition to keep growing CHARM-EU with the new proposal requires a long-term solution for support in CHARM-EU. A second argument for organizing this in a more permanent manner is that the learning curve of the CHARM-EU concept (educational principles and the technology used to support this) are quite steep. Continuously changing support requires a lot of knowledge transfer, which wastes time that can be better spent in supporting and improving CHARM-EU.

6. Outstanding VLE Requirements and continuous evaluation

We recommend taking note of the outstanding VLE requirements in appendix 1 for future editions of CHARM-EU. We also recommend to keep evaluating phase 2 and 3 of the master and use those lessons learned for future editions of CHARM-EU

Appendix 1: Outstanding VLE Requirements

Item	Implementation Status	Note	Ideal outcome
Accessibility	Partial	Generally good overall within the VLE components. Scorion accessibility will require further development.	Core platforms and all flexible apps conform with W3C / WHATWG guidelines and Universal Design principles.
Localization	Partial	Moodle platform can already support i18n localization. MS Teams is auto localised to the user's default system language.	Full localization support for all core and flexible apps.
Security	Partial	All the core platforms and flexible tools used were checked using Utrecht University's security framework. Not all applications used were fully compliant to the complete framework but no blocking risks for the pilot were found. Required improvements are discussed with suppliers and will be part of future tenders.	An European Security Framework is created that is adopted by all Universities and used to vet suppliers of IT components. Continue with the current strategy of selecting best in breed applications. Further improve the identity management though an IT Framework policy that can federate logins across the various web applications. Engage a specialist third party to perform a full security audit of the ePortfolio system.

Ongoing Pedagogical Requirements

Item	Status	Note
Activity Planning	Active	Ongoing weekly coordination meetings.
Operational	Active	Onsite teaching and technology support personnel.

Agreements	In progress	Inter-institutional agreements and common requirements.
IT Framework	In Progress	New IT Subgroup established