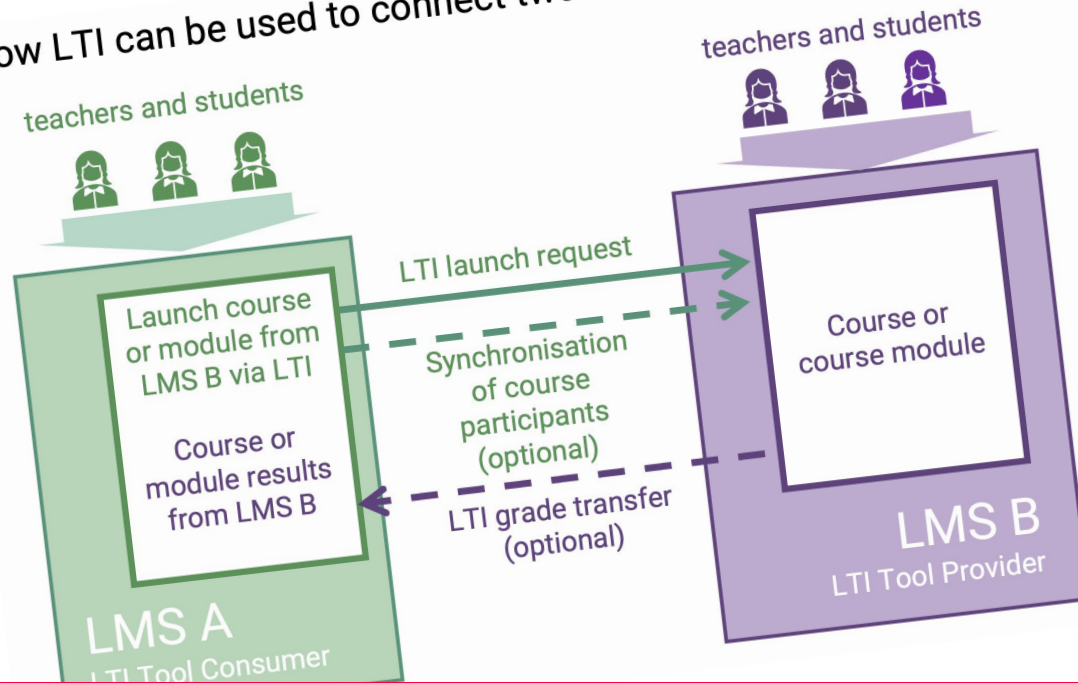How LTI can be used to connect two LMS ...

Martin Ebner (presenter)
Sarah Edelsbrunner
Katharina Gasplmayr
Katharina Hohla-Sejkora
Philipp Leitner
Sandra Schön
Behnam Taraghi

(all Graz University of Technology, Austria)

Federated virtual learning management in a European University alliance: General challenges and first experiences using LTI to connect LMS in Unite!

July 2024, Brussels

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Full paper

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Federated virtual learning management in a European University alliance: General challenges and first experiences using LTI to connect LMS in Unite!
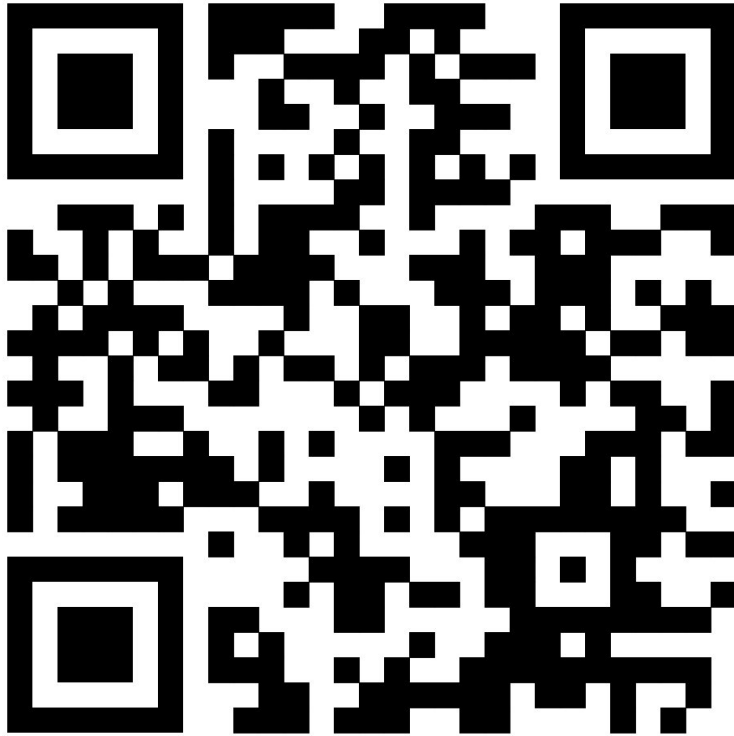https://doi.org/10.3217/hvftz-w4g37

Agenda

- Background
- Research Question and Design
- Results: Challenges of federated LMS in an alliance
- Results: Unite! Infrastructure
- Results: LTI Pilots
- Conclusions

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BACKGROUND

Background: TU Graz

Higher Education in Austria, Europe
- 9 million inhabitants, ❤ of Europe
- 22 public universities (51,000 students) (plus 21 universities of applied sciences, teacher training colleges and private universities)
- Most students attend public universities with comparably low fees (similar to Germany)

Graz University of Technology (TU Graz)
- Founded in 1811
  More than 13,700 regular students
- 7 faculties, 97 institutes, 3 campus locations
- About 180 Million Euro federal budget, 80 Million third-party funds

We do assess personal equippments of first year students since 16 years now and present our result at the annualy EdMedia/EDIL conferences.
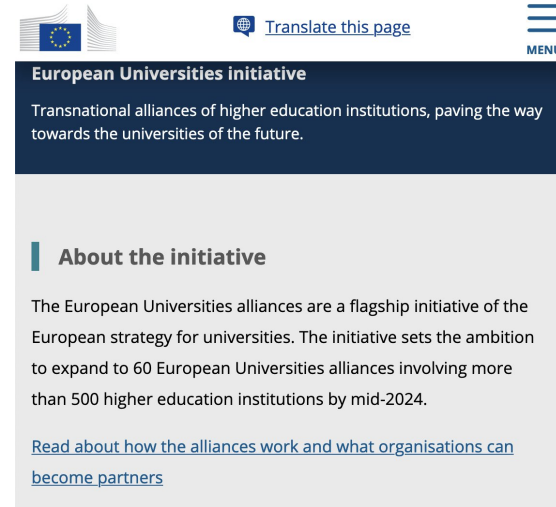
Source: Bundesministerium für Bildung, Wissenschaft und Forschung, https://www.bmbwf.gv.at/Themen/HS-Uni/Hochschulsystem.html,Statistisches Jahrbuch https://www.bmbwf.gv.at/dam/jcr:00d23d52-ba98-44a2-acf0-9188afc830c2/Stat_TB_2022_BF.pdf

Source: Homepage TU Graz, 12.6.2023

Background: European University Initiative

Over 40 European university alliances promoting academic exchange and innovation
Goals: enhance academic exchange, research cooperation, educational innovation

European Universities initiative

Transnational alliances of higher education institutions, paving the way towards the universities of the future.

About the initiative

The European Universities alliances are a flagship initiative of the European strategy for universities. The initiative sets the ambition to expand to 60 European Universities alliances involving more than 500 higher education institutions by mid-2024.

Read about how the alliances work and what organisations can become partners

© European Commission, https://education.ec.europa.eu/education-levels/higher-education/european-universities-initiative

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Background:Unite! Alliance


https://www.unite-university.eu/

Nine member universities

From Unite! Mission Statement 2030:

"Unite! creates the hybrid (virtual, physical and blended) and multilingual Unite! trans-European Campus with easily accessible joint educational offerings, shared and pooled resources, efficient services and green mobility"
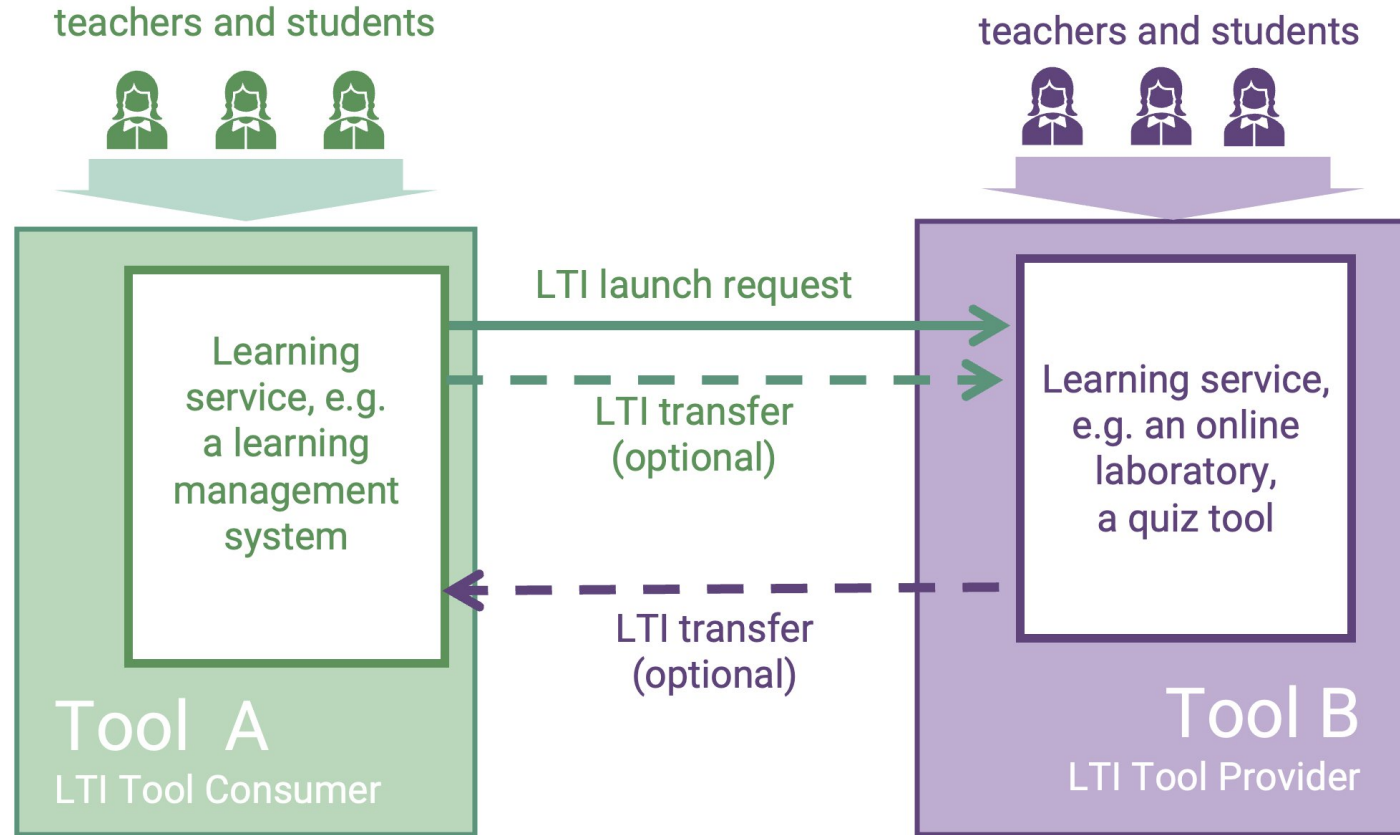

© Unite! alliance, https://www.unite-university.eu/

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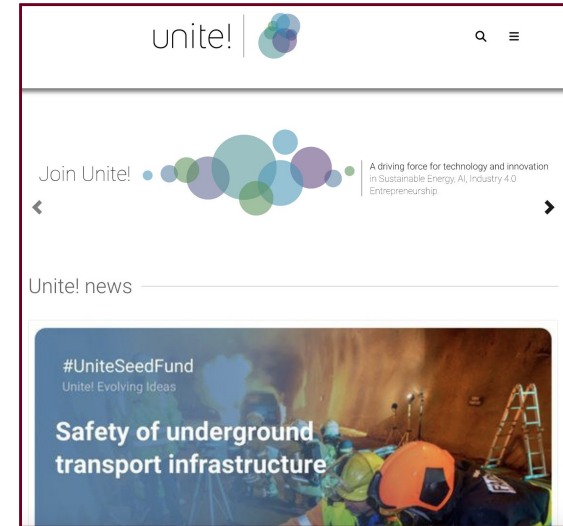
Background: Unite! Community 2 „Digital Campus"

- Responsible („only") for digital infrastructure for teaching and learning
- Challenges in digital collaboration and infrastructure integration

How LTI works

teachers and students

teachers and students

LTI launch request

Learning service, e.g. a learning management system

Learning service, e.g. an online laboratory, a quiz tool

LTI transfer (optional)

LTI transfer (optional)

Tool A
LTI Tool Consumer

Tool B
LTI Tool Provider

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Background: The Challenge

Build and develop further a well-functioning Learning Management System Infrastructure for our university alliance Unite!

RESEARCH QUESTIONS

Research Question 1

- What are the overarching challenges concerning learning management and the implementation of federated LMS within European alliances? (Within our European University Alliance Unite!)

Research Approach 1

- Literature Research (not systematically) on challenges of central/federated learning management in European university alliances by a multinational team of authors (see Ebner et al., 2024a, p. 31ff.)
- Descriptions of all Unite! partner infrastructures were created, which emerged iteratively in a process spanning several weeks (Ebner et al., 2024b)

Research Question 2

- Is Learning Tool Interoperability (LTI) a suitable tool for interconnecting LMS within a European university alliance?

Research Approach 2

- first experiences in piloting LTI within the Unite! alliance
- are described through case studies (cf. for educational research Hancock, Algozzine & Lim, 2021)

RESULTS: GENERAL CHALLENGES

Challenges & potential solutions using a federated learning management system (1/3)

Table 1: Sketch of challenges and potential technical and other solutions for using a federated learning management system in a European university alliance. Source: Ebner et al. 2024a, adapted

	Challenge	Potential solutions
Technical	Integration of the federated system in the heterogeneous landscape of existing infrastructure	Clarifying existing infrastructures of all partners and identification of incoherence, using standardized APIs, Service-Oriented Architecture (SOA), Identity and Access Management (IAM) and Integration Platforms as a Service (iPaaS)
	Needs to be capable of handling increased loads efficiently while maintaining performance and reliability (Scalability)	Continuous monitoring and performance analytics are vital to dynamically adjust resources and detect potential issues before they affect users
Legal	Different copyrights in Europe and possibility to use resources created by others (cf. Congleton & Yang, 2011)	Open licenses allow use
	GDPR needs to be respected for federated LMS (cf. Amo et al., 2019)	The strictest implementation as a benchmark, co-organization necessary
	Accreditation of learning results (Giralt et al., 2020) – certificates only for own students	Contracts by the alliance and EC / states

Challenges & potential solutions using a federated learning management system (2/3)

	Challenge	Potential solutions
Organizational	Different curricula and lectures need to be aligned.	Standards such as ECTS and another curriculum framework
	Translation of the materials might be needed (e.g., into English)	Appropriate and professional translation support; incentives for teaching external students who need translations
	Multilingual user guidance and support	Integrate staff of partner universities into user support
	Simple registration, authentification and authorization needed	eduGAIN or European student account
	Online assessment is a necessity (Rajagopal et al., 2023)	Tools and e-assessment
	Different schedules (Kjellgren & Serrano Van der Laan, 2023)	Good planning and flexibility
	Exchange of resources and course information	LTI-standard
	Support organization	Development of central services and interaction between partners' services

Challenges & potential solutions using a federated learning management system (3/3)

	Challenge	Potential solutions
Other challenges	User Experience	The design often must cater to the "lowest common denominator" to meet diverse user expectations and accessibility standards
	Prioritizing learners' perspective	Communicating that learners particularly benefit from using a federated system as it reduces their reliance on multiple platforms
	Motivational	Incentives to use the platform for teaching (learners should follow).
	Recognition of learning results (Buchem et al., 2018)	Several opportunities, e.g. open badges
	Multicultural issues (Kjellgren, Taylor & Serrano van der Laan, 2022)	Awareness and training
	New competencies (e.g. Learner skills) (Rajagopal et al., 2020)	Awareness and training
	Design for inclusion (Mangiatordi et al., 2019)	Instructional Design, awareness, training
	Pedagogical differences	Awareness and training

RESULTS:
UNITE!
INFRASTRUCTURE

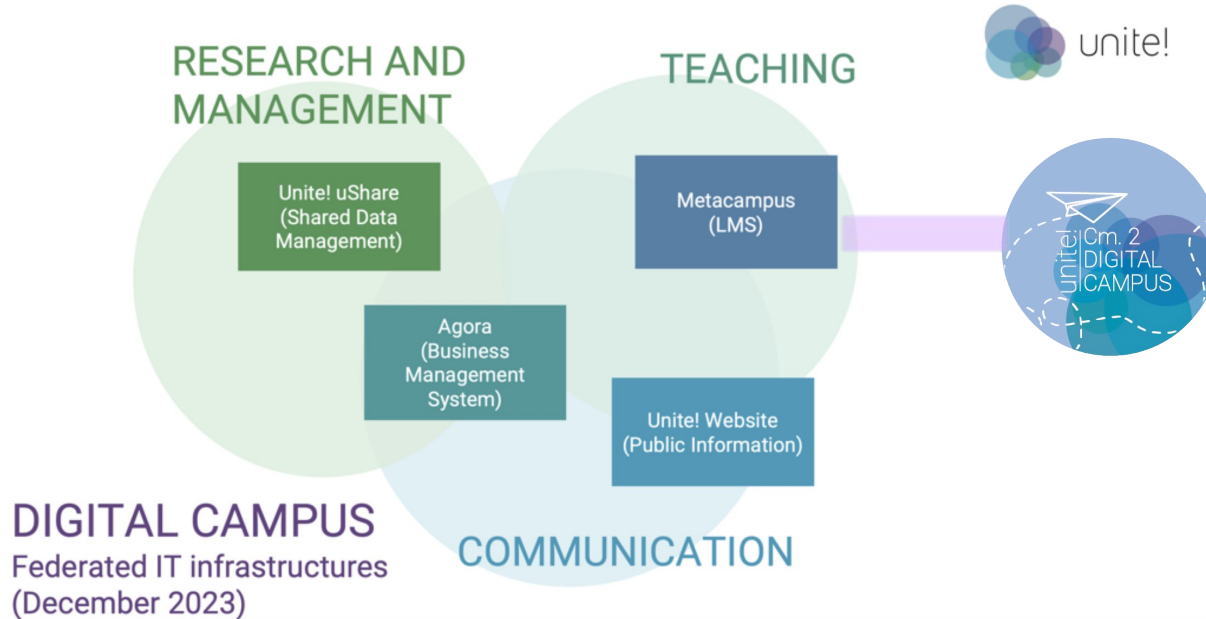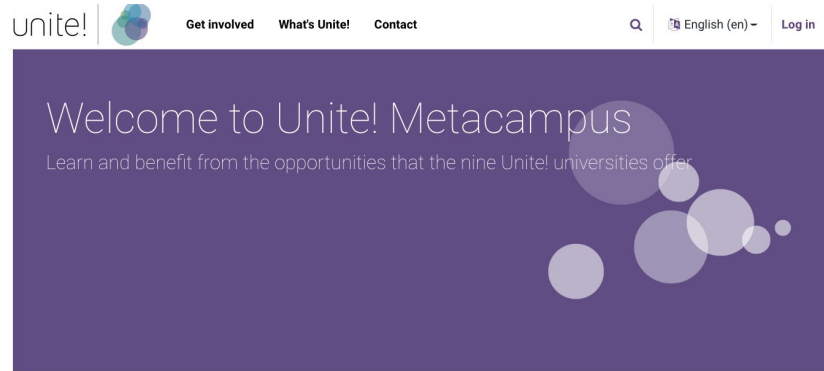# Unite!'s Digital Campus Infrastructure

Figure 1: Overview of the Unite! Digital Campus Infrastructure Key Platforms and their key applications

Metacampus Platform

Federated Learning Management System (LMS) based on Moodle (Open Source)

https://metacampus.unite-university.eu/

Features: interaction, multilingual support, eduGAIN authentication

© Metacampus, Unite!

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The LMS infrastructure of the European university alliance Unite! in early 2024

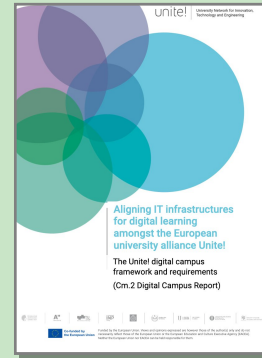**Table 2:** Overview of key issues concerning LMS in partner institutions of Unite! (10/2023). Source: Ebner et al. 2024c

	Main LMS	Open-Source	Secondary LMS	LTI interface	MOOC platform	EduGAIN
TU Graz	Moodle	YES	-	YES	Moodle	YES
ULisboa	Fenix Platform	YES	Moodle, Open edX	NO (Moodle: YES)	Open edX	YES
UPC	Moodle	YES	-	YES	-	YES
PoliTO	DIDATTICA	YES	Moodle	YES	Open edX	YES
UGA-INP	Moodle	YES	Chamilo	YES	-	YES
TUDa	Moodle	YES	-	YES	-	YES
Wroclaw Tech	Moodle	YES	-	YES	-	YES
KTH	Canvas	NO	-	YES	Open edX	YES
Aalto	Moodle	YES	-	YES	Moodle	YES

READ MORE

Ebner, M., Schön, S., Alcober, J., Bertonasco, R., Bonani, F., Cruz, L., Espadas, C., Filgueira Xavier, V., Franco, M., Gasplmayr, K., Giralt, J., Hoppe, C., Koschutnig-Ebner, M., Langevin, E., Laurent, R., Leitner, P., Martikainen, J., Matias, J., Muchitsch, M., Oller, M., Pereira, A.B., Petersson, J., Santiano, G., Schmidt, A. da Silva, F.M., Steitz, K., Taraghi, B., Torchiano, M., Villas, S., Würz, A. (2024). **Aligning IT infrastructures for digital learning amongst the European university alliance Unite! - The Unite! digital campus framework and requirements (1.0). Unite! Community 2 Digital Campus, Graz University of Technology.** https://doi.org/10.3217/36yen-0wy21

RESULTS:
LTI PILOTS

Connecting LMS with LTI

Connecting LMS with LTI step by step

IT departments — Preparation of both LMS ▶ support/admin — Deep linking of courses ▶ user — LTI launch request in a certain course

Connection of two LMS via LTI

How LTI can be used to connect two LMS from users' perspective

teachers and students

teachers and students

Launch course or module from LMS B via LTI

Course or module results from LMS B

LTI launch request

Synchronisation of course participants (optional)

LTI grade transfer (optional)

Course or course module

LMS A
LTI Tool Consumer

LMS B
LTI Tool Provider

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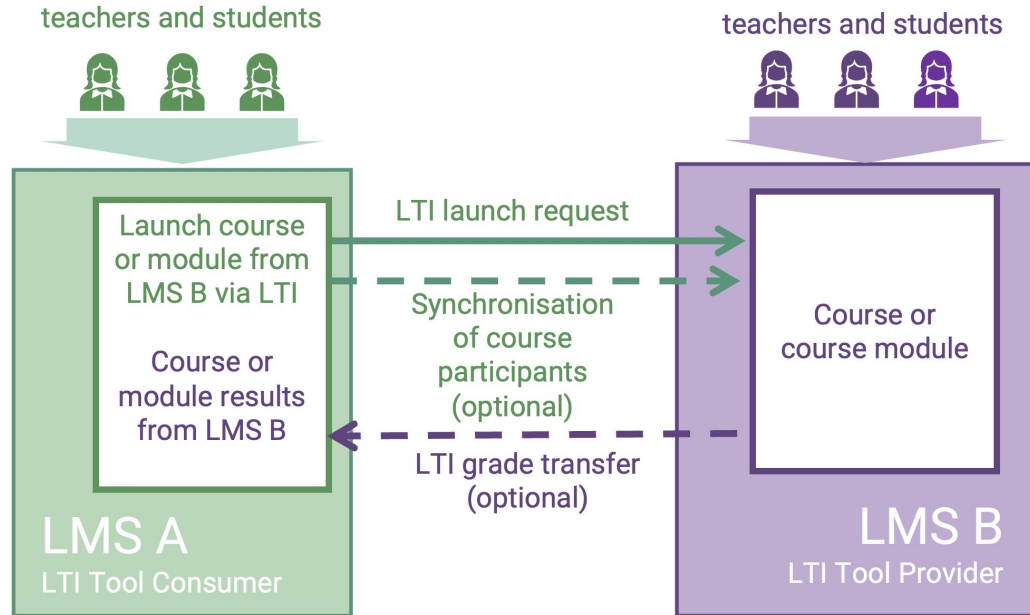
A vision

Vision: How LTI may be used to connect LMS within a university alliance
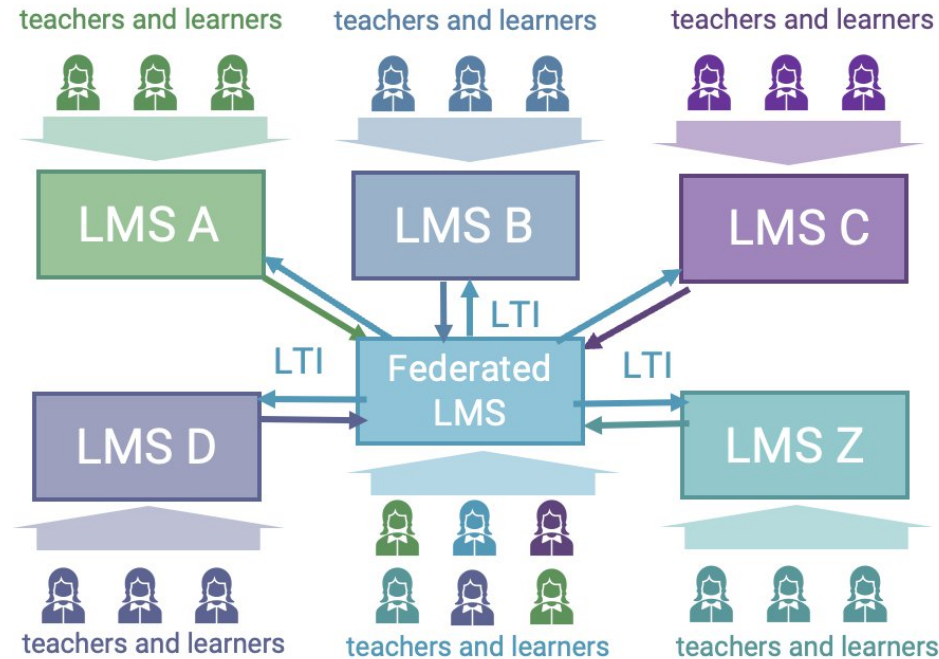
Overview of LTI pilots

The different LMS which were used are:

- TU Graz LMS (called „TeachCenter", hosted by TU Graz)
- National Austrian MOOC platform iMooX.at (hosted by TU Graz)
- Unite!'s federated LMS (called „Metacampus", hosted by UPC)

All: Moodle, Open Source

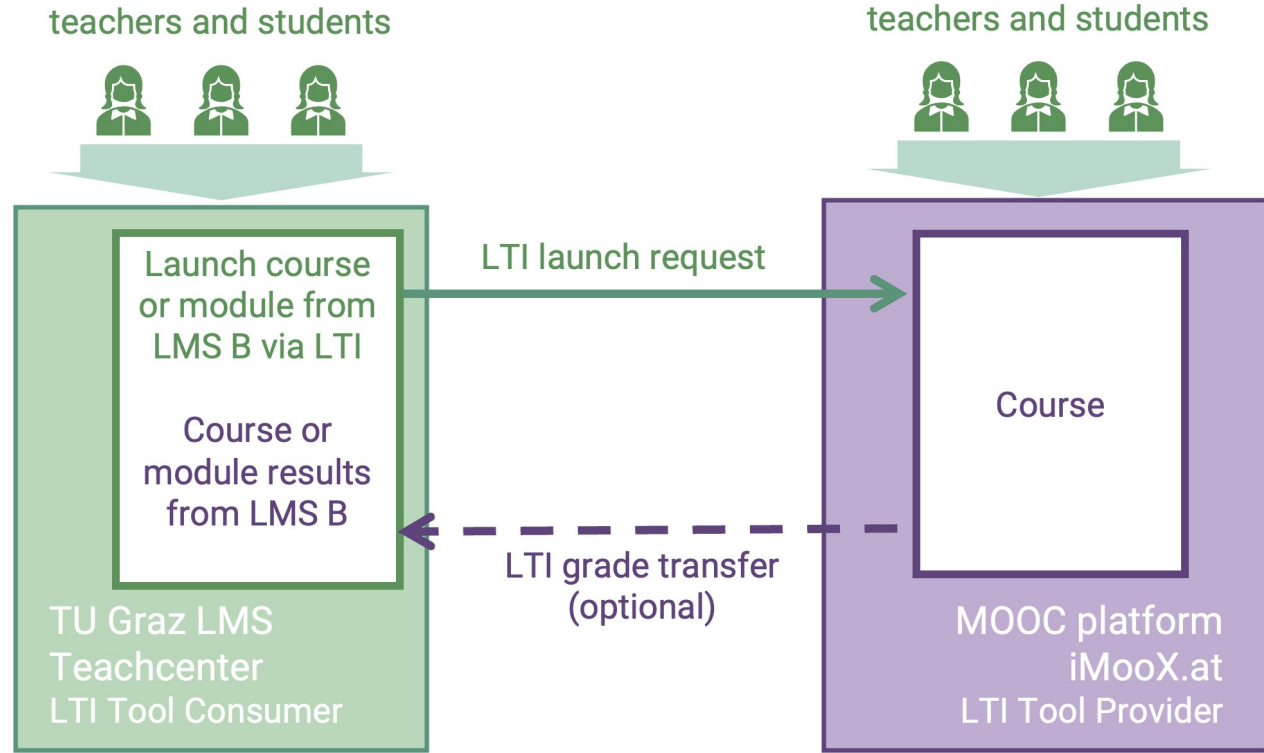# Overview of LTI pilots

LTI TOOL PROVIDER

LTI PILOT MATRIX (TU Graz)	Unite! Metacampus	TU Graz LMS (TeachCenter)	MOOC platform (iMooX.at)
Unite! Metacampus	(no need)	not tested	Pilot 2 (Greenchips tests case 2) Pilot 3 (OERcourse)
TU Graz LMS (TeachCenter)	Pilot 2 (Greenchips tests case 1)	(no need)	Pilot 1 (GADI & more)
MOOC platform (iMooX.at)	not tested	not tested	(no need)

LTI CONSUMER

Pilot 1

Pilot 1: LMS connection with LTI

Connecting the MOOC platform iMooX.at and the university LMS in several courses at TU Graz

teachers and students

teachers and students

Launch course or module from LMS B via LTI

Course or module results from LMS B

LTI launch request

Course

LTI grade transfer (optional)

TU Graz LMS Teachcenter LTI Tool Consumer

MOOC platform iMooX.at LTI Tool Provider

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Pilot 1

Connecting the MOOC platform iMooX.at and the university LMS in several courses at TU Graz

LTI in use to connect an LMS with a MOOC platform: How it looks
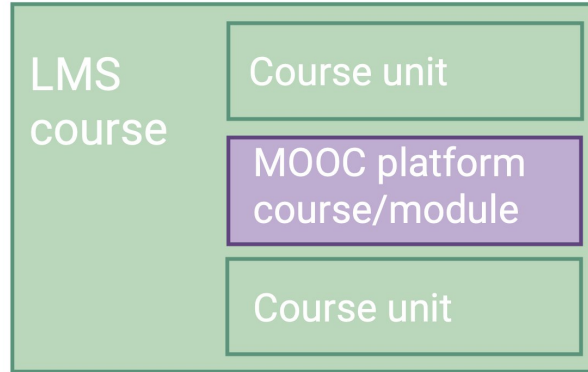
learners' perspective
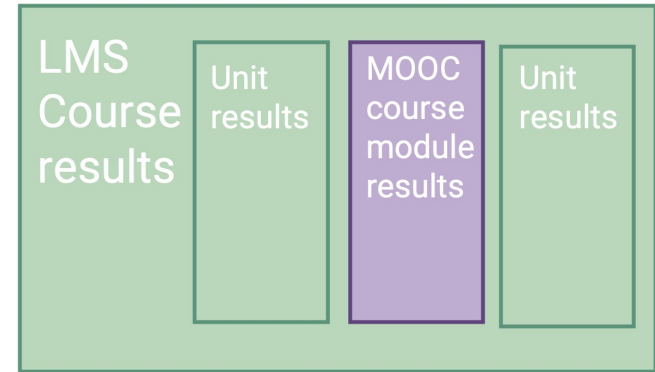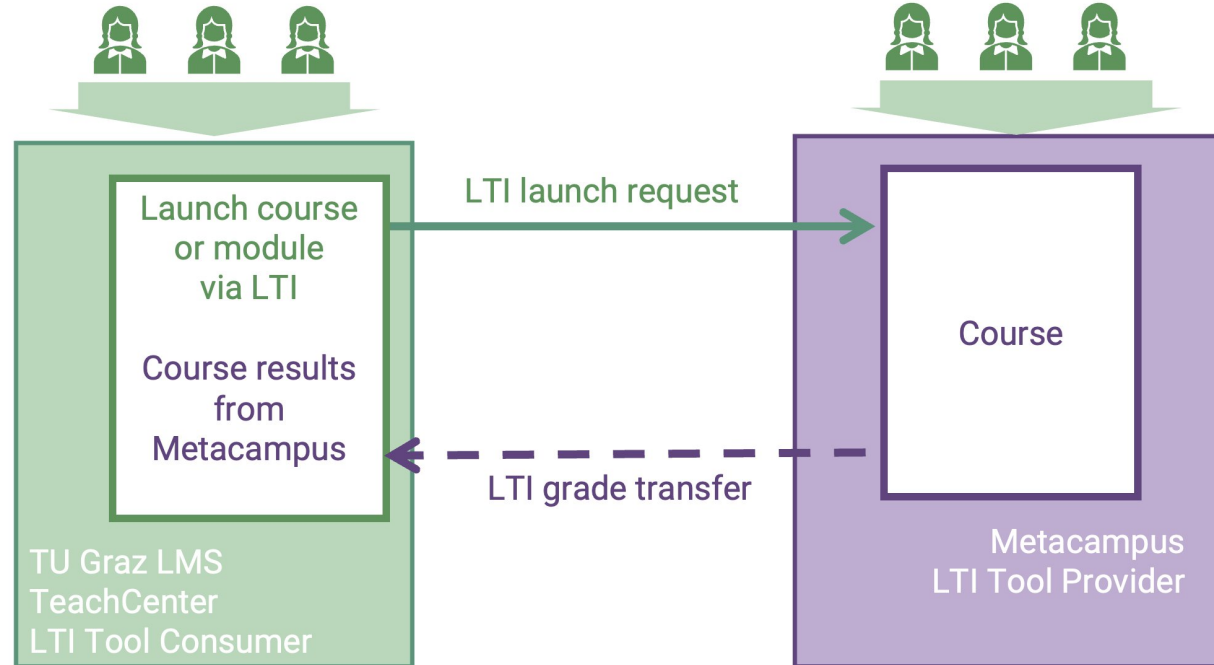
teachers' perspective

Pilot 2

Pilot 2: Case 1: LMS connection with LTI from users' perspective

Tests on Unite!'s Metacampus (Moodle) as LTI Tool Provider and LTI Tool Consumer

teachers and students from TU Graz
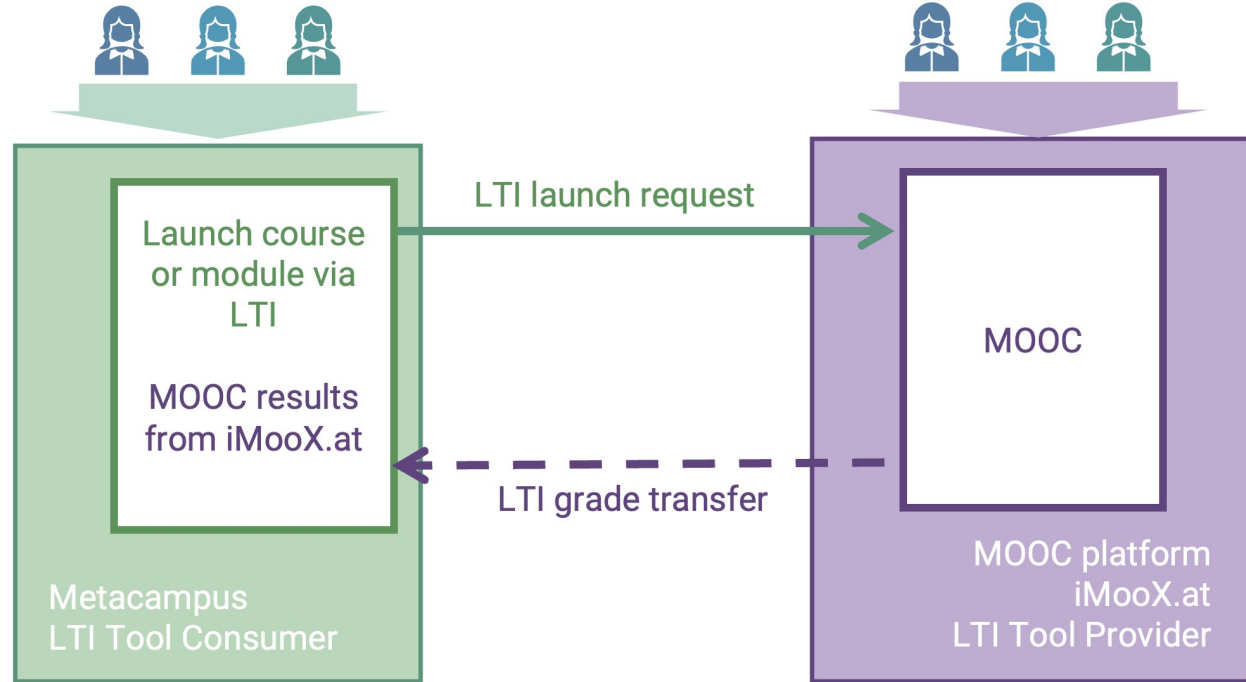
teachers and students from TU Graz

Launch course or module via LTI

Course results from Metacampus

LTI launch request

Course

LTI grade transfer

TU Graz LMS TeachCenter LTI Tool Consumer

Metacampus LTI Tool Provider

Pilot 2

Pilot 2: Case 2: LMS connection with LTI from users' perspective

Tests on Unite!'s Metacampus (Moodle) as LTI Tool Provider and LTI Tool Consumer

teachers and students from Unite!

teachers and students from Unite!

Metacampus LTI Tool Consumer

Launch course or module via LTI

MOOC results from iMooX.at

LTI launch request

LTI grade transfer

MOOC

MOOC platform iMooX.at LTI Tool Provider

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Pilot 3

Connecting a course at Unite!'s Metacampus with TU Graz MOOC platform

CONCLUSIONS

Remarks

- We used compatible LTI versions
- We linked existing user accounts on both platforms (we did not tested anonymous user accounts by the LTI tool provider)
- In our pilots TU Graz had access to all LMS –> effective support

Lessons learned

- Two browsers (Safari, Firefox) did not work (but with the latest installation it is no problem anymore)
- Linking with external LMS possible, but support and error identification more challenging
- Confirmed benefit: Central maintenance and up-to-dateness of course materials
- LTI fundamentally suitable for linking LMS
- Potential to enhance everyday life and teaching within European university alliances

Challenges and mitigation issues (1/2)

Aspect	Challenges	Mitigation Issues (if)
Technical	LMS with LTI integration are needed	Support development (strategy, budget)
	Users with some browsers (Safari, Firefox) had issues	Information, support
	Users have issues with the connection of their accounts or visibility of external content	Support, awareness, admin access to connected LMS
	If content needs to be copied/transferred to another LMS, same plugins and services should be available, or content needs to be adapted.	Awareness, support, requirement analysis – perhaps adding plugins
	Duplications and multiplications of user data across all systems could pose a challenge	Existing user accounts at both LMS required (but only in some use cases possible).
Legal	GDPR issues tackled	Organize access to data and adapt GDPR policy of connected platforms
	Integration of content from one LMS to another might cause copyright issues, especially when connecting platforms from different countries with differing copyright laws for educational materials	Providers agreeing on "minimal European standard" for networked LMS; using Creative Commons licenses such as CC0 CC BY and CC BY-SA; make copyright information visible to users of both platforms

Challenges and mitigation issues (2/2)

Organizational	Dependency on external LMS providers challenges digital sovereignty	Organizational and legal cooperation.
	Responsibility about content and service might be unclear	New structures and communication amongst partners with connected LMS are needed.
	Information and training of all relevant stakeholders and teachers of this (complex) new possibilities	Adaptation of all support materials, information of partners and support teams, communication to everyone
	Information and inclusion of e-learning support of all institutions	Competence development, meetings, communication structure
	Content and courses in other LMS might not be available in same time frame	Establishing communication about these issues, bringing together service teams of different LMS
	General issue of losing partners without LTI integration	Support development (strategy, budget)

MORE

Acknowledgements

Support of e-learning and IT experts from partner universities from Unite!

Funding from the European Commission (Erasmus+)
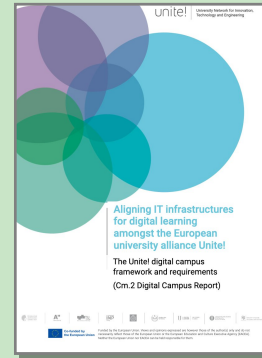
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Contact

Dr. Martin Ebner (head of Educational Technology team)
Graz University of Technology
martin.ebner@tugraz.at

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