TECOL – Technology-Enhanced Collaborative Learning

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EdTech and collaborative learning are two of the most discussed topics in Higher Education. This case study presents how the partnership between academia and business can foster in-classroom collaboration with the use of technology.

The TECOL project can be situated in this educational trend and started in 2016 as a collaboration between the KU Leuven (BE) and two industry partners (Barco and Televic Education). The main objective is to enhance interactivity, collaboration and flexibility in the learning process of University students using EdTech. Therefore, a selection of their learning spaces were redesigned and equipped with innovating educational technology. These redesigned learning spaces function as a living lab, called Edulab, to facilitate technology-enhanced collaborative learning in four different learning settings, i.e. the interactive lecture, collaboration learning spaces, multi-location learning and open learning centre.

PIONEERING TECHNOLOGY-ENHANCED COLLABORATIVE LEARNING

Over the last 50 years, computers became more and more present in all areas of human society. The field of education has not escaped from this evolution and an important shift towards increased digitalization has occurred. Therefore the use of EdTech in Higher Education is not new: smart boards, the use of tablets and the implementation of learning management systems are only some of the evolutions that have become commonplace during the last decade.

At the moment EdTech is still mostly used to organize the educational practice, spread information and facilitate communication between the different actors. But in-class interaction and collaboration, the learning process itself and multi-location learning are still only moderately supported and enhanced by technology. This leads to a discrepancy with the three main paradigm shifts that Higher Education is seeing today:

- From passive to interactive learning
- From individual learning to collaborative learning
- From one learning space to learning spaces in multiple locations
The Catholic University of Leuven in Belgium (KU Leuven) wants to pioneer this transformation and use EdTech to boost interactivity and collaboration, raise engagement levels and improve the success of students, because technology-enhanced collaborative learning is going to become more important as students need to be educated in a way that is consistent with the current context of our society.

“This is a unique chance for KU Leuven to position itself as a frontrunner in EdTech. More importantly, we hope to gain interesting insights into how technology can help boost interactivity and collaboration and, as such, raise engagement levels and improve the success of our students.”

Rik Torfs, Rector KU Leuven 2013-2017

TECOL PROJECT (Technology-Enhanced COLlaborative Learning)

The TECOL project (Technology Enhanced COLlaborative Learning) can be situated in this educational shift towards more collaborative and technology-enhanced learning. It was set up in 2016 at the KU Leuven (BE) in collaboration with two industry partners (Barco and Televic Education). The main objective is to enhance interactivity, collaboration and flexibility in the learning process of University students using EdTech. Therefore a selection of their learning spaces were redesigned and equipped with innovating educational technology. These redesigned learning spaces function as a living lab, called Edulab, to facilitate technology-enhanced collaborative learning in four different learning settings:

1. Interactive lecture – For example quizzes and polls can be launched through the TECOL platform to increase interactivity and formative assessment during lectures, using the bring your own device principle (BYOD).

2. Collaboration learning spaces – Learning spaces that empower collaboration and learning characterized by flexible work stations with bi-directional screen sharing between students and teachers, interactive document collaboration, peer rating systems, etc.

3. Multi-location learning – The TECOL platform not only offers opportunities for on-campus learning, but also provides the opportunity for connecting remote classes or individuals in an interactive way, overcoming the limitations of distance to enable remote student-teacher interaction.

4. Open learning centre – Student organized open learning spaces where students can come to do personal work, group work or exercise their presentation skills in an EdTech equipped setting.

Watch the video: TECOL project introduction

The TECOL technologies that are being developed will be actively used in all forms of face-to-face instruction, ranging from the standard lectures to exercise and practical sessions. Simultaneously research will be done on
how interaction and collaboration in a multi-location setting can be realized. By doing so these technology-enhanced learning spaces aim at increasing the engagement level of the students, which should ultimately lead to better learning outcomes and the development of skills relevant to modern-day society.

PARTNERS

The realization of the TECOL project was a cooperation between three partners:

1. **KU Leuven** – During the development phase the specific research expertise of the KU Leuven Campus Kulak in Kortrijk was drawn upon, more particularly their iMinds research team ITEC and Faculty of Psychology and Educational Sciences. Also the Faculty of Medicine, which in recent years gathered a lot of experience in setting up collaborative learning spaces, brought the necessary knowhow to the project. Finally all faculties, continuing education and staff services were involved in the broader implementation and spreading of the project results.

2. **Barco** – A company that has been pioneering for years in the field of visualization and connectivity. With their ‘Education’ incubator they offer solutions to facilitate collaborative learning in learning spaces.

3. **Televic Education** - Was founded in 1956 as part of the Televic Group and has become a world leader in the development and implementation of scientifically designed solutions for e-learning, online assessment, collaborative learning, digital multimedia and language labs, interpreter training systems and learning management systems.

   **Watch the video: TECOL project partners**

LIVING LABS @ KU LEUVEN

KU Leuven worked with Barco and Televic Education to set up a number of ‘living labs’ on their Kulak Campus in Kortrijk. In 2016 they started with redesigning a selection of their learning spaces and equipping them with innovating educational technology. These redesigned learning spaces functioning as living labs, called Edulab, were used to pilot technology-enhanced collaborative learning environments for a two-year period in four different learning settings: the interactive lecture, collaboration learning spaces, multi-location learning and open learning centre. Here, students and teachers are using the TECOL solutions and implementations in authentic learning settings, which allows evaluation and fine-tuning based on a design-based research approach. Central to all this is the TECOL online platform that was developed to facilitate the technology-enhanced collaborative learning in practice in these different learning settings.
A multi-discipline project team was formed to set up these environments and to assess their impact. The core team included two professors, two IT experts, a researcher, the lead for education in their faculty and a project manager (who managed the project, coordinated the research, promoted the project and advised teachers on course redesign).
TECOL Platform

To facilitate the technology-enhanced collaborative learning in practice in the four different livings labs (learning settings) the TECOL online platform was developed. This collaborative online platform forms the basis for all the learning activities and uses the ‘bring your own device’ principle (BYOD) promoted by KU Leuven. It not only offers opportunities for on-campus learning, but also provides tools for connecting remote classes or individuals in an interactive way. The TECOL platform was developed by the industry partners and integrates:

1. **Barco's weConnect system** – Provides an easy to use, campus-wide user experience for collaborative learning as multiple screens can be shared simultaneously.

2. **Televic Education's collaborationQ platform** – Cloud-based platform that provides interactive and collaborative learning activities.

During the course of the project these existing technologies where joined in the TECOL platform, which was then extended substantially based on the specific needs of the learning settings in the different living labs. Here are some of the main features used in and developed for the TECOL project:

- In-class polls, quizzes and silent questions
- Web lectures (live and recordings)
- Annotation possibilities for web lectures and course material
- Bi-directional screen sharing
- Tracking learning activities and progress
- (A)synchronous collaboration tools
- Multi-location learning
- Peer review and rating system
**Living Lab 1 – Interactive lecture**

The first living lab aims at using EdTech to make lectures more interactive. Here the teacher has the possibility to easily project a presentation wirelessly from his own device and he can add extra (external) material and sources when needed. Furthermore the interactivity between teachers and students will be encouraged by their ability to launch quizzes or polls through the TECOL platform directly to the personal device of the students, which allows teachers to receive real-time feedback during class.

Students also have the option to ask questions during the lecture without breaking the flow of the lecture using the ‘silent question’ function (anonymous and indirect) on the platform. Fellow students can then ‘like’ these questions so the teacher gains insight in their priority. All these Q&A will stay available after class and can help students while studying and teachers with optimizing their course.

A teacher has the ability to stream and/or record his lecture through the platform. During and after class students have the possibility to add annotations and other learning materials to these recordings, which they can then share with their fellow students. In addition, multiple classrooms can be merged to virtually form one single room using bi-directional sound and video recording. In this way, the students who were unable to get a seat in the big lecture room could still follow the interactive lecture remotely.
Living Lab 2 – Collaboration learning spaces

For the second living lab learning spaces were redesigned as collaborative learning spaces using innovative educational technologies. These spaces are more specifically designed to facilitate exercise and practical sessions. All functionalities of the interactive lecture are also made available here, with some extra features that support collaborative learning.

The design is based on flexible workstations with interactive displays allowing bi-directional screen sharing between students and teachers, which allows them to simultaneously consult and collaborate on different resources. Teachers can use this technology to supervise the learning progress of the students and offer tailored guidance by showing for example the progress or working process of one group to another.

Currently the technological partners are working on the further development and integration of the document collaboration and peer rating features of the platform. Another innovative feature that they hope to add in the near future is the possibility to consult an external expert during the sessions, for example a live connection with the local hospital during a medical session.

Living Lab 3 – Multi-location learning

Next to the functionalities of the interactive lecture and the collaborative learning spaces, an important additional feature is making multi-location learning possible. In the third living lab an immersive setting was set up in which students on different locations could still be part of the classroom with equal interaction possibilities as the students present in the physical
room with the teacher. This is done by virtually merging multiple classrooms to form one single room using bi-directional sound and video recording, overcoming the limitations of distance to enable remote student-teacher interaction.

Two different variants of multi-location learning were offered through the TECOL platform:

1. **Remote classroom** – Based on a collaboration between different campuses of the KU Leuven. Two student groups attend the same lecture each from their respective campus auditorium. The lecture itself can be organized on one of the respective campuses or remotely.

2. **Virtual classroom** – Students from different individually chosen remote locations join the centrally given interactive lecture through the TECOL platform. This format offers advantages especially for working students, staff trainings and Erasmus students.

**Living Lab 4 – Open learning centre**

The fourth living lab, the open learning centre, differs from the other three settings because it's fully student organized. Students are responsible for all bookings and for shaping their own learning activities. Students can come here to do personal work, group work or exercise their presentation skills in an EdTech equipped setting.

**VALIDATION THROUGH RESEARCH**

The TECOL project started in March 2016. During the first year it focused on the interactive lectures and collaboration learning spaces. From 2017 the
other settings, i.e. multi-location learning and open learning centre, were introduced and tested. Use cases for all different learning settings were devised in different faculties to set up a thorough validation of the project through extensive effectiveness research. Through a design-based research approach characterized by an iterative implementation research in an authentic learning setting to gain a detailed insight into the acceptance of the EdTech used and the learning effects. The following three complementary research methods were used:

1. **Focus groups** – Allows direct contact with teachers on their needs and experiences.
2. **Survey research** – Used to systematically and extensively question all users involved (teachers and students).
3. **Learning analytics** – Analysis of user data to gain insight into learning processes of the students.

To examine and account for the acceptance and the intention of use of the TECOL technologies, the Technology Acceptance Model (TAM) was used. Precedent research states that especially ‘Perceived ease of use’ (PEU) and ‘Perceived usefulness’ (PU) have an influence on the possible use of a technology in future learning, the ‘Behavioural intention’ (BI). All these aspects were incorporated in the surveys used to question the students and the teachers.

**RESEARCH RESULTS - ACCEPTANCE AND INTENTION OF USE OF TECOL TECHNOLOGIES**

The main results on acceptance and intention of use on the developed TECOL technologies are positive regarding the ease of use, possibility to support the learning process and future use. Especially the following items received mainly positive feedback and are seen as an added value during the learning process:

<table>
<thead>
<tr>
<th>Students</th>
<th>Teachers</th>
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</thead>
<tbody>
<tr>
<td>1. Screen capturing lectures &amp; board</td>
<td>1. Quizzes &amp; Polls</td>
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<tr>
<td>2. Annotation features &amp; sharing</td>
<td>2. Screen sharing</td>
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<tr>
<td>3. Quizzes &amp; Polls</td>
<td>3. Screen take over</td>
</tr>
<tr>
<td>4. Silent questions</td>
<td>4. Screen capturing lectures &amp; board</td>
</tr>
<tr>
<td>5. Planner for collaboration moments</td>
<td>5. Annotation features &amp; sharing</td>
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*Watch the video: TECOL user testimonials*
RESEARCH RESULTS – DEVELOPMENT AND IMPLEMENTATION CHALLENGES

Developing and introducing this kind and amount of technologies also presented some challenges, a major one being the adaption of the new technologies. Adoption of these new technologies and learning spaces can be quite a lot of investment for a teacher. They can’t just come in and start a lecture, they need to re-think the design of their course to make the best use of the space. The concept has to be sold to the faculties and their members. That’s why regular tours and ‘hands-on’ workshops with different faculties were organized. Once people have tried the technology they realize “it is perfectly manageable and not rocket science”, their fears of losing control melt away.

Some tips, based on experiences during the TECOL project, to overcome these hurdles when developing and implementing new educational technologies to optimize learning:

1. If you want to deliver change you need to know your users and you have to know what both students and teachers really need

2. If you are in the change process, include ambassadors within the faculties, people who know the specific needs and issues of their relevant faculty and can spread the latest information.

3. Give yourself time, success will not come overnight, learn from your successes and failures and take small steps

FUTURE OF TECOL

After the pilot run (2016-2018), the successful elements were then included in the rollout to other faculties and the project team has grown to include ambassadors in each faculty, who have proved very helpful in terms of encouraging adoption and identifying specific issues within their faculty.
The opening of the Edulab at KU Leuven Campus Kulak in Kortrijk in 2017 as an interactive testing environment where students can use technologies that enable interactive and collaborative learning, in combination with a partnership with Imec’s smart education program that focuses on the efficient use of educational technologies, guarantees the ongoing research into, development of and optimization of the TECOL technologies.

We have only just started seeing the added value of technology in Higher Education. It’s only the ‘tip of the iceberg’. In the future the TECOL project team will keep striving for EdTech that enhances interactivity, collaboration and flexibility in the learning process of University students while reducing the ‘cognitive load’ of the students and ‘orchestration overload’ of the teachers.

RELATED ARTICLES

- Technology-Enhanced Collaborative Learning for improved interactivity, collaboration, and flexibility in higher education and corporate training, Annelies Raes, presented at CSCL 2017
- Students’ perceptions towards the use of Technology-Enhanced Collaborative Learning (TECOL) in higher education, Annelies Raes, presented at ICLS 2018
- Trailblazing technology-enhanced collaborative learning – Interview with project manager Ine Windey