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A New Digital Era for European Universities: Implementing Large-scale AV Projects for the Next Generation Digital Hybrid Classrooms - A quick-start guide from 0 to 10: Challenges, Benefits, Pitfalls

Georgios Roussos[1*], Dimos Charidimou[1†], Anastasios Petalotis[1], Angeliki Agorogianni[1]

[1] IT Center - Aristotle University of Thessaloniki (AUTh), Greece

grou@it.auth.gr, dharidimou@it.auth.gr, petalotis@it.auth.gr
aagorogi@it.auth.gr

Abstract

Many universities had started designing and implementing digital transformation plans before the outbreak of the COVID-19 pandemic, including Audio-Visual (AV) infrastructure for teaching and learning. The COVID-19 pandemic has accelerated the need for European universities to adapt their teaching methods and embrace new digital tools. Implementing large-scale AV projects for the next generation of digital hybrid classrooms has emerged as a promising solution. Focusing on the Aristotle University of Thessaloniki (AUTh) case, this paper examines the challenges, benefits, and things to avoid when implementing AV projects in European universities. The paper also presents a roadmap for universities to successfully implement AV projects from 0 to 10, considering the necessary steps, resources, and expertise required at each stage. The challenges of implementing AV projects in universities include the need for significant investment, the complexity of AV systems, technical expertise (e.g., experienced AV integrators), and the difficulty of adapting teaching methods to the new digital environment. However, the benefits of implementing AV projects are manifold, including enhanced student engagement and interactivity, improved learning outcomes, the ability to reach remote learners, and enhanced inclusiveness. To ensure the success of AV projects, universities must avoid common pitfalls such as underestimating the necessary

* https://orcid.org/0000-0003-2311-5196
† https://orcid.org/0000-0002-7602-3650

resources and expertise, failing to involve faculty and students in the design process, and neglecting to provide adequate training and support for faculty and staff. In conclusion, implementing large-scale AV projects for the next generation of digital hybrid classrooms presents a unique opportunity for European universities to adopt modern teaching methods and better meet the needs of today's learners. With careful planning, investment, and collaboration among all stakeholders, universities can successfully implement AV projects and realize the benefits of a new digital era for higher education.

1 Introduction

The COVID-19 pandemic has transformed the world of higher education, with universities forced to adapt their teaching methods to meet the needs of the digital age (Roussos et al., 2022). The rise of digital technologies and the need for social distancing has accelerated the need for European universities to embrace new digital tools and adapt their teaching methods (Kalfa et al., 2021). Implementing large-scalel AV projects has emerged as a promising solution, providing a way to create the next generation of digital hybrid classrooms that are both engaging and interactive. This article examines the challenges, benefits, and potential pitfalls of implementing AV projects in universities, focusing on the Aristotle University of Thessaloniki (AUTh) case.

The paper is organized as follows:

- Chapter 1 provides an introduction to the topic and context,
- Chapter 2 offers a quick-start guide for implementing large-scale AV projects,
- Chapter 3 delves into the challenges faced during the implementation process,
- Chapter 4 discusses the pedagogical and technical benefits of digital hybrid classrooms,
- Chapter 5 highlights potential pitfalls to avoid, and
- Chapter 6 presents some positive results and experiences of AUTh in implementing AV projects.

By examining the challenges, benefits, and pitfalls of implementing large-scale AV projects for digital hybrid classrooms, this paper aims to contribute to the ongoing discourse in higher education and provide valuable insights for universities embarking on similar endeavors.

2 Implementing Large-scale AV Projects for the Next Generation Digital Hybrid Classrooms - A quick-start guide

A quick start guide can be very beneficial to AV project implementation. It can help provide a clear, concise, and easy-to-follow roadmap for project managers and team members to ensure everyone is on the same page and understands their roles and responsibilities (Singh, 2021). It can also help identify potential challenges and risks, provide tips and best practices, and ensure that critical milestones are met on time and within budget.

All of the above can ultimately lead to a more prosperous and efficient AV project implementation, mainly when referring to multidisciplinary, constantly changing, and comprehensive environments like universities. The IT Center of AUTh has created an informative, quick-start guide that covers the following 10 steps:

1) Determine the goals and objectives of the project, including the desired outcomes and benefits.
2) Conduct a needs assessment to identify the necessary AV equipment and software.
3) Develop a budget for the project, including the cost of equipment, installation, and training.
4) Select a team of experts to design and implement the AV project, including an AV specialist, IT specialist, and instructional designer.
5) Plan the AV system design and layout to ensure it meets the needs of the hybrid classroom.
6) Determine the installation schedule and ensure it is done during a time that will not disrupt classes or cause significant downtime.
7) Train faculty, staff, and students on how to use the AV equipment and software.
8) Test the AV system to ensure it is fully functional and meets the desired outcomes.
9) Develop a plan for ongoing maintenance and support of the AV system, including regular checkups and updates.
10) Evaluate the success of the AV project and make any necessary adjustments for future implementation.

3 Challenges of Implementing AV Projects for Hybrid Learning

The challenges of implementing AV projects in universities include the need for significant investment, the complexity of AV systems, technical expertise, and the difficulty of adapting teaching methods to the new digital environment. Universities must carefully consider the necessary resources and expertise required at each stage of the implementation process, from planning to full-scale implementation. The following paragraphs will analyze the key challenges.

3.1 Planning - Goals and objectives

Planning and investment are critical components of implementing AV projects for hybrid classrooms in a European university. It requires significant hardware, software, and infrastructure investment. For example, 2019-2022 was the last large-scale AV project, including the digital transformation of 105 classrooms and amphitheaters. IT Center of AUTh, had to carefully evaluate the way, time, and costs of implementing AV projects and develop a budget and funding strategy to support the initiative according to strict deadlines during and after the COVID-19 pandemic and the war in Ukraine (Agaltsova & Milyaeva, 2021). The main objective of the AV project was to provide teachers with an easy, efficient, and a fully automated way to broadcast and record their lessons in digitally upgraded classrooms without human intervention and technical assistance (Roussos et al., 2022). The live broadcast would be made available on the websites of the various departments of the university's faculties. At the same time, video recordings are stored in secure data centers managed by the IT Center of AUTh.

3.2 Technical Expertise

Implementing AV projects require effective management to ensure project deliverability on time, within budget, and to the required quality standards. It also requires integrating specialized audio-visual equipment from different vendors, software development, and network administration expertise. IT Center of AUTh had to identify the necessary technical skills and knowledge, develop an appropriate AV project managing team, develop a strategy for acquiring or developing this expertise, and develop a project plan that includes milestones, deliverables, and timelines.

3.3 Planning the AV system design and layout

The design of AV projects indeed considers the needs of students and faculty and the technical requirements of the technology and infrastructure. Lecture live streaming and recording without technical team intervention and videoconferencing capabilities in classrooms were a crucial aspecton the project's assets.

AUTh had to consider European standards and project deadlines to submit the appropriate designs for approval. At that stage, the IT Center of AUTh had to involve faculty members and sometimes students in the design process to ensure AV projects meet their needs and effectively achieve the desired learning outcomes. Moreover, according to building infrastructure, IT Center of AUTh had to deal with different sizes of classrooms and offer options counting the same time, the need to address compatibility issues to ensure that all AV components will work together seamlessly. Last-minute changes to the plan were also a big challenge. It is worth mentioning that the design was made before the pandemic outbreak (Agaltsova & Milyaeva, 2021).

3.4 Building infrastructure and on-site inspection

Implementing AV projects in a large University is complex work. It requires changes to the physical infrastructure of classrooms and other learning spaces, approvals by Deans of Faculties and Presidents of Schools, and continuous information to all involved about the slightest change in procedures, tasks, etc (Landes & Rapp, 2022) (Hashemi & Cederlund, 2017).

IT Center of AUTh, with the cooperation of Faculties, had to evaluate and upgrade its infrastructure as needed to support the implementation of AV projects from over 600+ auditoriums, classrooms, labs, etc. In addition, IT Center of AUTh in collaboration with the Head of the schools had to prioritize which buildings and 105 specific classrooms were high priority and fit the academic needs for AV improvement on time.

The on-site inspection in the classrooms showed that we had to divide the project into smaller sub-projects depending on the size of the audience, the type of services provided, and the kind of equipment IT Center of AUTh would install. So the IT team decided to follow four different types of AV implementation. A selection of specific equipment for each one was a challenge. More specifically:

- Type_A implementation applies equipment intended for audiences and halls with a capacity of up to 100 students.
- Type_B implementation for audiences with up to 300 students.
- Type_C implementation for audiences and halls with a capacity of up to 60 students and
- Type_C+ implementation for audiences and halls capacity of up to 40 students with advanced capabilities for courses through videoconference.

3.5 Low product availability and deliverability

The implementation of the project coincided with a significant degree of uncertainty in the external environment due to the pandemic and the war. Supply chain issues and delays caused daily challenges, and the strict time plan of the project forced the IT Center of AUTh to search for alternative solutions. Unexpected issues about a product availability on the market and deliverability were a daily challenge.

3.6 Coordination with classroom schedules and academic calendars

Implementing a large-scale project in 105 classrooms spread all over the campus and outside the main campus (even in another city) in 9 months required much team effort and careful scheduling.

The primary challenge was coordinating all involved parties' programs, including faculty, staff, AV technicians, and IT support, to ensure classroom availability and the project's timely completion. This coordination required careful planning, effective communication, and adaptability to unexpected

events. The risk of delays and conflicts was always high during or after the pandemic and during the academic semester and exams when lesson schedules were often subject to change.

The integration process involved integrating various AV equipment, such as cameras, microphones, network devices, displays, and more, which required technical expertise in-person or remotely. Another challenge was the technical risks, such as equipment failure and network issues, which sometimes disrupted the installation or configuration process during implementation. The hard part was ensuring all components worked seamlessly in a complex network of university environments , which required extensive testing and troubleshooting (Mashhadi & Kargozari, 2011).

3.7 Implementations inside and outside of Campus

The AV project installation at AUTh involved implementing audio-visual equipment on and off campus, including in remote areas. This issue posed significant logistical challenges, particularly with the transportation and storage of equipment in these remote areas. However, there were often issues with the timely delivery of equipment or devices that had problems upon arrival, also known as d.o.a. This caused delays and disruptions to the installation process and required careful coordination and communication to ensure the installation timeline.

3.8 Security and privacy of AV processes and data according to GDPR

With the increasing use of AV technologies in higher education, ensuring the security and privacy of AV data and recordings is crucial. Compliance with General Data Protection Regulations (GDPR) involves implementing appropriate policies and procedures for handling personal data, obtaining consent where necessary, and ensuring that data is processed lawfully and transparently (Sugianto, 2020). The IT Center of AUTh had to implement appropriate measures and adopt policies to protect against unauthorized access or use of sensitive data.

3.9 Training of academic staff and the role of departmental power user

Training academic staff on new AV equipment is challenging due to scheduling conflicts, technical expertise gaps, and potential resistance to change. Departmental power users can be critical in providing ongoing support and encouraging faculty to adopt new teaching methods.

During the AV project installation in 105 classrooms, one of the most significant challenges was training academic staff (teaching administrative and technical personnel) on the new AV equipment and technology. The training was necessary to ensure faculty members could effectively use and integrate the latest technology into their teaching methods. However, providing adequate training to many faculty members presented several challenges (Ozerbas & Erdogan, 2016).

Another challenge that the team at the IT Center of AUTh faced was scheduling the training sessions to accommodate the busy schedules of faculty members. Additionally, the training required technical expertise, which was not always available or accessible (Fjørtoft, 2020). Ensuring faculty members had access to ongoing technical support was also challenging, at least initially, despite the degree of automation applied. Finally, some faculty members may have resisted change, making it difficult to encourage them to adopt new teaching methods. Despite these challenges, academic staff training was crucial to the success of the AV project installation.

3.10 Maintenance and Support

The new equipment required regular maintenance (i.e. updates, bug fixing) to ensure it was functioning correctly, which required a dedicated team and resources. Additionally, providing ongoing technical support to faculty and staff was crucial to ensuring the successful adoption and integration of the new technology into the learning environment. Ensuring timely responses to technical issues and ensuring

support was available during busy periods such as exam season required careful planning and coordination. Additionally, ongoing support and maintenance require significant time and resources, which could be challenging for some universities.

4 Benefits

Despite the challenges, the benefits of implementing AV projects, specifically hybrid digital classrooms, technological equipment, and tools for educational material production in universities, are manifold. Aristotle university tries every year to adopt and support those benefits.

4.1 Pedagogical view

Firstly, the Hybrid mode promotes effective pedagogy by allowing faculty to incorporate various teaching strategies, such as hybrid tasks and collaborative learning activities (Støckert, 2019). The hybrid also creates a more engaging and interactive learning experience for students, providing access to multimedia resources, and ultimately improving student satisfaction and learning outcomes. Moreover, hybrid digital classrooms help create a more accessible learning environment, enabling students with disabilities to access course materials and resources (Landes & Rapp, 2022)

Hybrid lessons in synchronous digital classrooms also provide a flexible learning environment, allowing students to access course materials and resources at their own pace and schedule, improving student retention rates.Furthermore, hybrid digital classrooms can enhance communication between students and faculty, leading to more effective feedback and collaboration. Faculty members can also collaborate more effectively by sharing resources and best practices (Roussos et al., 2022).

AV projects for hybrid classrooms can increase faculty productivity and reduce the administrative burden of traditional teaching methods . By implementing some or all of these strategies and utilizing AV technology, IT Center of AUTh provides new learning opportunities for all students and creates a supportive and inclusive environment that enhances the universities' extroversion (Roussos et al., 2022). Another benefit is that a hybrid digital classroom can help universities save on costs by reducing the need for large audiences' physical infrastructure and materials (Støckert, 2019).

Lastly, another important benefit is the ability to record lessons and make them available through an e-learning platform that is a game-changer in modern education (Roussos et al., 2022). By recording and sharing video lessons, universities can offer students greater flexibility and accessibility to their course content. This technology allows students to watch lectures on their own time, review difficult concepts, and study at their own pace. Additionally, educators can use video lessons to reach a wider audience, including those who cannot attend traditional classes due to distance or scheduling conflicts.

4.2 Technical view

The digital hybrid classroom offers several technical benefits, including centralized management and administration of devices, enabling IT Center of AUTh administrators to monitor the status of devices, track hours of use, and schedule turn-on/off times to optimize energy consumption. Additionally, remote updating technology ensures that all devices are up-to-date with the latest software, reducing the need for manual updates and increasing security. Managing devices centrally also enables administrators to troubleshoot issues remotely, reducing downtime and minimizing disruptions to classroom activities. Overall, these technical benefits of the digital hybrid classroom offer a more streamlined and efficient way to manage and monitor classroom technology, ultimately leading to a more effective and productive learning experience for both sides (Roussos et al., 2022) (Vermette et al., 2019). In addition, the numerous benefits provided by the digital hybrid classroom are unquestionably paving the way for future technological advancements at an even more rapid pace. These future enhancements have the potential to bring about substantial advantages, such as

incorporating and supporting virtual and augmented reality tools within the educational environment. Such advancements could further transform and modernize the learning experience, taking education to an entirely new level of engagement and immersion (Roussos et al., 2023b).

5 Things to Avoid – Pitfalls

As universities across Europe continue to adapt to the new digital era, it is crucial to consider the potential pitfalls that may arise during the implementation of large-scale AV projects for hybrid classrooms. The following points of attention by the IT Center of AUTh may help institutions avoid common mistakes and ensure successful project outcomes.

One of the most critical factors to consider is the selection of appropriate AV integrators, equipment, and technologies according to classroom and audience size. It is essential to assess the institution's specific needs and ensure the selected equipment is compatible with the existing infrastructure. Institutions must also consider the costs associated with the equipment and technologies, including maintenance and support.

One common pitfall when implementing AV projects is the possibility of receiving faulty devices or seemingly compatible devices. This issue can appear despite efforts to purchase high-quality equipment and can cause delays in the installation process and additional costs for replacement devices. It is essential to work with reputable vendors and thoroughly test all equipment before installation. However, even with careful planning and testing, unexpected issues may arise during the installation and implementation. To mitigate this risk, scheduling dedicated troubleshooting days into the project timeline is essential.

Delay in project deadlines is another pitfall. With many stakeholders involved, including faculty, students, IT staff, and administration, competing demands for resources and attention may exist. To avoid delays and missed deadlines, it is essential to establish clear communication and expectations among all stakeholders and regularly monitor progress toward critical milestones. Building contingencies and buffer time can help accommodate unforeseen challenges and ensure the project stays on track.

Ensuring that all faculty and staff in the project receive proper training and support to use new AV technologies effectively is crucial but very challenging. This includes training sessions, workshops, and online resources like manuals and videos. Institutions must also prioritize data security and privacy when selecting equipment and providing training, ensuring compliance with data protection regulations and clear guidelines for using and sharing AV materials. Collaboration between different departments and stakeholders is essential, with regular meetings, workshops, and planning sessions necessary to establish clear communication and promote effective teamwork.

Finally, institutions must consider the potential impact on students and their learning experiences. Institutions should ensure that students have access to the necessary AV technologies and resources to engage with the new hybrid digital classrooms fully (Roussos et al., 2023). It is also essential to monitor the impact of the latest technologies on student engagement, satisfaction, and learning outcomes. By considering these potential pitfalls and taking steps to avoid them, institutions can successfully implement large-scale AV projects for the next generation of digital hybrid classrooms.

6 Results

Implementing large-scale AV projects for digital hybrid classrooms can present several challenges, but the benefits and results can be impressive. Below are some examples of successful AV projects in Aristotle university (Figure 1).

Figure 1 - Hybrid Digital Classroom, Faculty of Law, AUTh

This Law School classroom is modern and high-tech, featuring state-of-the-art audio-visual equipment and a collaborative layout. With touch panel monitors, multiple high-quality screens, microphones with geolocation, and two 4K PTZ cameras, students can easily share and interact with content. This immersive learning environment encourages student engagement and enhances learning outcomes.

Figure 2 shows also the result before and after the large-scale AV implementation in the School of Medicine that supports the hybrid learning mode.

Figure 2 - Hybrid Digital Classroom, Faculty of Health Sciences, AUTh – Before, After

These images demonstrate the potential benefits of implementing large-scale AV projects for digital hybrid classrooms.

In addition to the examples provided, AUTh has successfully implemented large-scale AV projects in various other faculties and departments, further demonstrating the widespread applicability and impact of such initiatives. For instance, the Faculty of Engineering has incorporated digital hybrid classrooms with cutting-edge AV equipment, enabling students to engage in complex simulations and virtual laboratory experiments. Similarly, the Faculty of Sciences has adopted AV technology to facilitate interactive learning experiences in informatics, biology, chemistry, and physics, using multimedia presentations and live-streaming services to explore and expand complex scientific concepts (Roussos et al., 2022). This approach not only enhances the learning experience but also broadens the reach of scientific knowledge beyond the classroom.

In the case of AUTh in practice, the established infrastructure has yielded remarkable results, contributing to a wide array of applications. These include:

- fostering collaboration through joint Master's degree programs with national and European universities,
- expanding access to higher education via online Master's and lifelong learning programs,
- enriching the learning experience by providing comprehensive educational materials to all students through the university's asynchronous autonomous and on-premises learning platform (elearning.auth.gr), and
- streamlining AV infrastructure management by adopting a centralized model, which offers advantages in terms of maintenance, energy efficiency, and coordinated planning. This innovative approach has positioned AUTh as a pioneer in the digital transformation of European higher education, effectively adapting to the demands of the new digital era.

By providing students with an engaging and immersive learning experience, promoting collaboration and personalized learning, and increasing accessibility and flexibility, these projects can help universities to stay competitive in the digital age and provide students with the tools and resources they need to succeed at the European level.

7 Future Plans and Recommendations

AUTh's successful large-scale AV projects have led to future plans and recommendations for other institutions. The university targets a 25% increase in digital hybrid classrooms over three years and will develop ongoing maintenance and support strategies.

Furthermore, AUTh plans to expand live streaming services and explore the integration of AR/VR technologies in classrooms to facilitate immersive and interactive learning experiences, enhancing the teaching and learning process across all faculties (Roussos et al., 2023).

Key recommendations for other institutions include: a) engaging stakeholders from the start. b) allocating sufficient resources for training and support c) prioritizing flexibility and scalability in AV system design d) conducting thorough evaluations during and after implementation.

Sharing these insights contributes to the discussion on digital hybrid classrooms in higher education. By embracing digital transformation and continuously improving AV systems, European universities can foster innovation, inclusivity, and excellence, supporting a competitive and inclusive European higher education landscape. This paper serves as a valuable resource and guide for institutions seeking to implement AV projects and create engaging digital hybrid classrooms.

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