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Digital Educational Platforms For Inter-Organizational University Collaborations

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ABSTRACT

Collaboration is a long and strong academic tradition, with many initiatives like Erasmus+ and EIT aimed at sharing resources in engineering education areas such as sustainable energy and AI. Despite numerous examples, little is known about the best ways to approach, sustain and support university collaborations, particularly when earmarked funding ends. What we do know is that many of these collaborations anchor in digital educational platforms, which support either the creation or delivery of courses, and at times even both.

This paper employs a qualitative, multiple case study to explore approaches to create and challenges with maintaining sustainable university collaborations. We show that the design of collaborative processes and choice of digital educational platforms to support the collaboration are tightly connected. We propose three models for approaching inter-organizational university collaborations; (1) Focus on creating organizational collaborations; (2) Focus on creating and sharing content; and (3) Focus on creating common delivery of courses. It is noteworthy to mention that these are not mutually exclusive alternatives but rather a prioritization of which focus comes first.

KEYWORDS

Education collaborations, University collaboration, Digital educational platforms, Collaborative challenges

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Introduction

Universities of the future are facing newness, including new organizational forms (e.g. platform universities or microcolleges), new ways to teach (e.g. massive open online courses – MOOCs), new groups to teach (e.g., in professional education and lifelong learning), new technologies (e.g., large language models, learning analytics etc.), and new subjects in engineering (e.g., AI, ethics, wicked problems) (Staley, 2019).

These changes are likely to translate into a need for new skills amongst teachers (e.g., the use of digital tools or teaching in hybrid settings), and a need for new collaborations (Romeu et al., 2015), such as sharing material, sharing teachers or sharing students between universities. Universities of the future

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are key in facilitating social, environmental and economic development for sustainability. Universities should thus partake in public and private partnerships and cocreate knowledge for the challenges ahead (EUA Briefings, 2018; Talab et al., 2018). In response to complex challenges, organizations are increasing their inter-organizational collaborations (Cricelli & Grimaldi, 2010), in universities this occurs both at national and international level.

Prior research has discussed inter-organizational collaborations regarding teaching (eg. Nerlich et al., 2012) and regarding research (eg. Boardman & Corley, 2008; Knobel et al., 2013). Many of these have focused on industry-university collaborations (eg. Bruneel et al., 2010; Rybnicek & Königsgruber, 2019), rather than collaboration in-between different universities (cf. Borrego & Newswander, 2008). There is some research regarding university collaborations for teaching to be found, however. Such research discusses for instance blended learning for online teaching over organizational boundaries (Nerlich et al., 2012), inter-organizational university teaching grant collaborations (Willcoxson et al., 2011), and interpersonal characteristics that affect the quality of collaborations (Borrego & Newswander, 2008).

Many studies on collaborations focus on success stories, whilst collaborations in practice often tend to fail (Rouzbehani, 2020). A first step in understanding why collaborations fail is to analyze the common barriers of collaborative governance, which Rouzbehani (2020) has done and categorized these into communication, cognition and power barriers. Barriers manifest themselves throughout collaborations, but often barriers that emerge early may be related to challenges in later stages (Rouzbehani, 2020).

Less research is to be found on how collaborations in-between universities are created and managed, although it has been acknowledged that collaborations between universities are advantageous for both knowledge exploration and exploitation (Talab et al., 2018). This void includes little research on the consequences of creating collaborations based on what is being shared, such as; sharing content, sharing courses (creation and/or delivery thereof), sharing students, sharing teachers, sharing digital educational platforms for teaching (such as Canvas or Moodle), sharing digital platforms for collaboration (such as repositories), or sharing processes (for how to work and interoperate).

The use of digital educational platforms is increasing in teaching and has foundationally affected what education is and how it is produced and delivered (van Dijck, 2018). The possibilities of information and communication technologies for teaching collaborations has also been attested to in prior research (Romeu et al., 2015). It has even been claimed that platforms for knowledge sharing and collaboration may address several barriers to collaboration, although such claims rely on online collaboration platforms (Rouzbehani, 2020).

Inter-organizational university collaborations often manifest in the creation of digital educational platforms, see for instance Unite! Metacampus (2024) or InnoEnergy Respository (2022). Some collaborations have set out to create their own digital platform for teaching, in order to provide content and run courses. Other collaborations have chosen to utilize existing platforms such as Canvas or Moodle, see for instance SSES platform (2024). Yet other inter-organizational university collaborations have approached digital platforms in education differently: The Unite! Metacampus has created a digital platform for access to courses, activities and interactive workspaces (2024), whilst the InnoEnergy repository enables the creation, sharing, finding and customization of teaching material (InnoEnergy Repository, 2022).

Every digital educational platform has its pros and cons and fits various users differently (Yazici & Özerbaş, 2021). What they do share, is that they require technical support and maintenance, as well as content creation, usage and updates. The digital educational platforms in universities set the stage for how courses and teaching may be performed and developed, both individually and collaboratively. There is a multitude of educational platforms available today, with their respective advantages and drawbacks. The pros and cons of each individual platform call for trade-offs and prioritizations, since

not one single system is superior in functionality and usability. Regardless of which technical solution is chosen, the choice has consequences for how collaborative education should and could be organized and managed.

Initiatives to create inter-organizational collaborations often enjoy special funding to be set up and get underway, e.g. EIT (including InnoEnergy or Digital), European University Alliances (such as Unite!), and IDOCOS. When the earmarked funds run out, the initiatives tend to lose momentum. To be able to make initiated, strategic decisions about creating inter-organizational collaborations that lasts over time, alternatives and uncertainties connected to building a new education organization across universities and digital, educational platforms to support such a collaboration needs to be explored.

This paper presents an analysis of various approaches to creating inter-organizational university collaborations in teaching, specifically considering the manifestation in digital platforms for sharing teaching material. We take a resource perspective in this research (Berends & Sydow, 2019), meaning that we focus on the resources needed for inter-organizational university collaborations, including teaching, administrative, IT, and technical resources.

The study originates from a national initiative to set up an inter-organizational university collaboration for AI education in Sweden. The research is approached qualitatively by comparing multiple cases of inter-organizational university collaborations, from which three models for approaching the collaboration are derived. The purpose is to explore approaches to create and challenges with maintaining sustainable university collaborations, with many participating higher education institutions. To fulfill this purpose we ask:

RQ1: How may educational collaborations be approached in-between universities?

RQ2: What challenges arise in the intersection between digital educational platforms and processes for collaboration?

In this paper we use the label inter-organizational university collaboration to signify the kind of collaborative efforts that emerge in-between university organizations with different rules, procedures and digital educational platforms governing their work. Whether such collaboration appears in-between universities or within the same university matters less. What is of importance is that the collaboration involves several organizational units that use different digital educational platforms and adhere to different rules and procedures for teaching and crediting. This, in turn, affects how students are admitted, how teaching is performed, how teaching material is shared, how credits are assigned etc.

The study is undertaken from the perspective of a Swedish, national context. This implies that the collaborating organizations abide to the same laws and regulations. The Swedish context matters for the purpose of this study since universities are highly regulated when it comes to admission, competition, issuing degrees etc. Some Swedish universities are even governmental agencies. Some of the studied cases are undertaken in an international context. We have then disregarded specific aspects of collaboration that stem from differences in laws, regulations, culture and language.

Background and origin of study

There is a large research program called WASP (Wallenberg Autonomous Systems and Software Program) in Sweden. The aim is to propel the nation to the forefront of artificial intelligence, autonomous systems, and software development. WASP aims to not only deepen national expertise but also to bolster global recognition, through a multifaceted approach encompassing research projects and industry collaboration (WASP homepage, 2024). The WASP program started in 2015, and after

many years with extensive research focus, a new phase was initiated to scale up education based on the knowledge developed in the program: WASP-Ed. WASP-Ed has the purpose to significantly increase the capability and capacity of Swedish universities in providing timely, relevant, and scalable education in AI and other transformative technologies (WASP-Ed homepage, 2024).

The fundamental challenge that WASP-ED is designed to address is how Swedish universities can step-up and provide relevant and timely education at scale when the demand for competence in new technologies such as AI suddenly explodes and vastly broadens. The expected impact is a national step-change in the quality and quantity of available competence in AI as well as for coming transformative technologies (WASP-Ed homepage, 2024).

This research is part of a work package focusing specifically on digital educational platforms to support inter-organizational university collaborations at national scale. The label digital educational platform is used to signify digital platforms for sharing teaching material both in-between teachers and with students. As part of setting up an inter-organizational collaboration the assumption leading to this project was that the choice of a digital educational platform affects how collaborative activities can be undertaken. For instance, certain digital educational platforms may create a collaboration founded on manual, administrative processes that increase with the number of universities that choose to partake.

Research setting: Processes and digital platforms for university education

The use of digital platforms in university teaching has increased over the years and is today part of delivering courses. The digital platforms set boundaries for the production, performance and enactment of education, which affect the autonomy of the teacher (Grimaldi & Ball, 2021).

Yet, the digital support systems might appear quite simple from a teacher's perspective. Most users engage with a couple of user-friendly systems to perform their daily activities: teachers use digital educational platforms in their courses and administrators use digital administrative tools. When looking beneath the hood, however, a myriad of interacting systems appears that support the student journey throughout the education. A Swedish university typically has around 30 different IT systems to support this journey that are integrated to a digital platform of the university, see Figure 1 for one example of the complexity.

Providing education in one university alone is thus a complex endeavor, both in terms of processes for admission, education and crediting as well as the integration of multiple IT-systems to support such processes (Lassi et al., 2022), amongst them digital educational platforms. Figure 1 illustrates the administrative organization surrounding education in one university.

In the center of the figure, we see the overall educational process: *plan, recruit, admit, educate, evaluate*. The gray boxes show the activities related to the corresponding process. The white boxes within are the different IT-systems supporting the activity. The arrows show the principal data flow between the systems. Typically, this data and many other data flows form the base of interaction between systems, creating a complex environment. In the Swedish setting, with national systems for admissions and student administration (participation, result and degree) generally requires a mix of internally developed and commercial-off-the-shelf (COTS) solutions to support the educational process. The blue line shows a student journey with connections to the corresponding supporting activities.

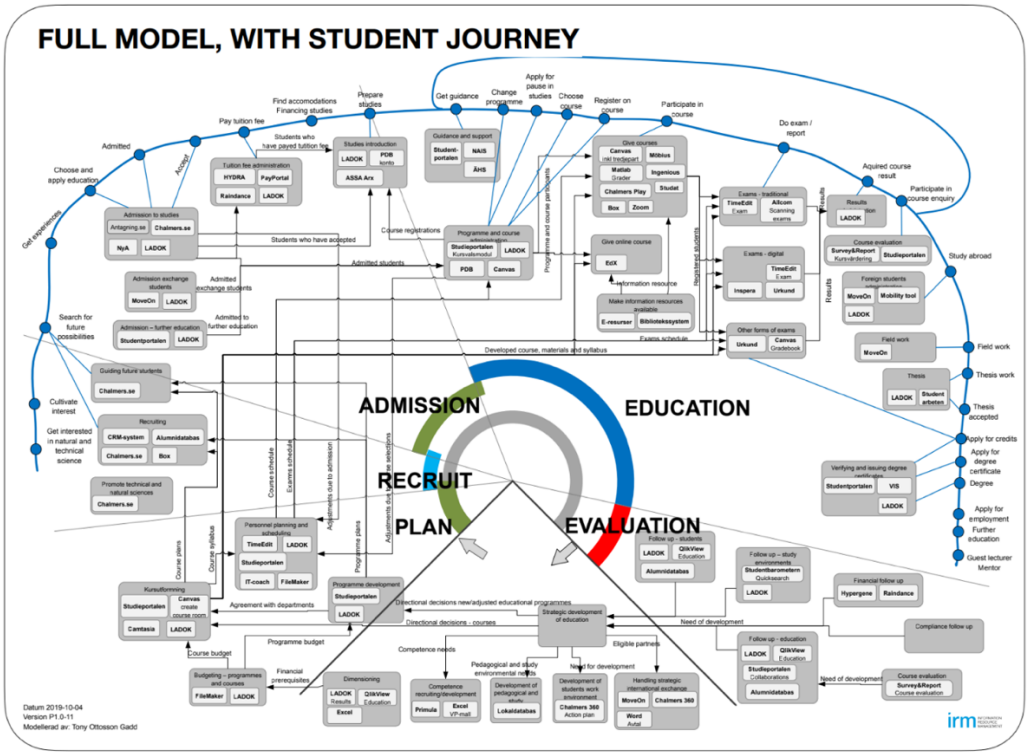

Figure 1 : Illustration of the student journey as the Milky Way, by Tony Ottosson Gadd in Lassi et al. (2022)

Despite the complexity, there are numerous examples of trying to create various inter-organizational collaborations. Inter-organizational collaborations mean that several of these “solar systems” need too function during the collaboration. For students going on international exchanges there have been established and well-functioning collaborations for many years. In Sweden, these international exchanges have been founded on that students are admitted to their home university and in essence switch place with another student under a mutual agreement for exchange, thus national laws for enrollment does not apply. The same solution is not possible to do nationally within the country borders, which creates a barrier to national mobility.

The IDOCOS Handbook (Ampadu et al., 2022) has illustrated how complexity in collaborations increase with geographical outreach (from institutional, through national, regional, interregional, to globally) and with depth of collaboration (from co-created courses, through shared courses, co-created and shared courses, shared instructors/supervisors, joint programs, to joint program and degree diploma). The perspective of IDOCOS is on doctoral education, however, which is substantially smaller in terms of volume compared to collaborations for undergraduate and postgraduate educations. The matter of volume may be assumed to have bearing for how much manual labor that is needed in-between the intra-organizational processes to make the collaboration work, and as such affect the complexity. If, for instance, all students have to be admitted manually, and all credits have to be registered locally at each university this drives costs and efforts.

One of the cases in this paper, WASP-ED, is an initiative to create national, undergraduate AI education at scale which means dealing with big volumes of students and many partaking universities. The inter-organizational collaboration thus needs to be founded on processes and rules that enable scaling without excessive costs in manual labor, having to make decisions for exceptions and the like.

Introducing yet another system is often not welcomed with open arms, as each new system adds to the complexity as shown in Figure 1. Development, implementation, management, and maintenance of IT solutions is generally both expensive and time-consuming. It may require expertise that in many cases

is overallocated in the organization (IT and information security, contractual law, procurement, etc.). Moreover, the users of these technical platforms (teachers, administrators, and students) have already invested time and competence training in learning how to use the main educational platform. After all, a technical platform is merely the format for providing education, whilst teachers and students should primarily want to focus on the content in education.

The Critical Studies in Education journal published a special issue on digital education platforms in 2021, arguing that the prevalence of such systems was increasing (Decuypere et al., 2021) and that a "critical platform gaze" is needed. The contributing articles studied various aspects of digital educational platforms, but did not include inter-organizational university collaborations as one such aspect.

Research setting: The current state of digital educational platforms in Sweden

Canvas is currently the dominating educational platform at Swedish universities, see Table 1, while a few other systems are used at smaller scale. Generally, all universities use one main Learning Management System (LMS) where most courses exist and where course and account administration are automated (Hill 2024). The main LMS is usually integrated with several external learning tools and the national Ladok system. Often there are also some institution- or domain specific LMS or legacy LMS that are maintained in parallel.

Table 1 : Educational platforms in use at Swedish universities (October 2022), source: Sunet (2022)

Educational platform	**Used as primary system (complementary system)**
Canvas (Sunet)	28
Blackboard/Blackboard Ultra	3 (1)
Its learning	2
Lisam, O365/Sharepoint*	1
Moodle	2 (1)

While the table presents the main LMS used, there are other platforms that might be used in parallel. For example, KTH has Canvas as its main LMS, but also uses other systems in different initiatives such as Unite, European Institute of Innovation and technology (EIT) InnoEnergy and Stockholm School of Entrepreneurship (SSES). The same pattern is discernible also at other universities.

To collaborate nationally to increase efficiency in developing course content, deliver online courses and support data-driven learning analytics, an appropriate strategy must be created. Such a strategy should be based on a thorough analysis of the possible alternatives, which in turn should anchor in experiences from previous multi-university collaborations.

Before creating a platform, in this case a national platform for all universities to use within the Wasp-Ed program, the respondents in thus study stress that one should question the basic assumption whether a system is needed and map the possible alternatives with their respective pros and cons for various stakeholders such as the Wallenberg foundation, future users (teachers, students, administrative staff) and IT-departments (responsible for procurement, implementation, support, and maintenance).

One reoccurring example is that many projects are challenged with both very little content on the platform after the project is done, as well as a high maintenance cost. Another reason is that while building a platform is a clear output, the necessary job to decide how we collaborate, how we enroll students, how we give credits, how we change money, how we decide requirements on the new platform, and how we maintain what is developed during the project etc. is often neglected or started too late in the process.

Universities are organized in different ways, the organizations use different technical platforms, users have different technical maturity, use different methods for teaching and examination and consequentially also then different modules and course structures. Coming up with joint requirements can thus be a challenge.

Method and case selection

This research relies on multiple case studies of initiatives to create inter-organizational university collaborations in education, which we study qualitatively. The cases have been studied both by gathering public, written information online as well as through roundtable discussions with representatives from these collaborations. This allows for triangulation of data sources following Stake (1995), as common in qualitative research (Yazan, 2015). Including multiple cases has allowed us to study approaches to inter-organizational educational collaborations from multiple, complementary perspectives (Stake, 2006).

The roundtable discussions have allowed us to ask about and compare both the setting up of inter-organizational university collaborations in education, as well as the challenges between digital educational platforms and organizing of these collaborations. This has as such contributed to answering both research questions. Moreover, we have probed deeper into one case by complementing the gathering of written material with a semi-structured interview. The interview focused on the details of the collaboration, how courses are created and delivered, how students are admitted and credited and what challenges that have been encountered. This has been undertaken to understand the phenomenon of *educational collaborations between universities* by studying both commonalities and differences across the cases (Stake, 2006).

Three of the four coauthors have much experience from working with digital educational platforms, from various perspectives. The current or prior roles include vice-president for digitalization, chair of IT platform for education, and head of IT development. We rely on Secules et al.'s (2021) guiding questions for reflecting on dimensions of positionality in the following statements: Combined the three authors share a lot of "know-how" when it comes to implementing digital educational platforms and are aware of many initiatives to create inter-organizational university collaborations in education in Europe ("know-that"). This has impacted our understanding for the need to study educational collaborations between universities, as well as the challenges with implementing digital educational platforms for such collaborations. To reduce bias in terms of aiming to confirm one's own opinions, the first author has acted as an outsider with little prior experience of setting up university collaborations or implementing digital, educational platforms. As such, the potential drawbacks of 'insiderness' such as "reduced explanations from participants and potential blurring of professional boundaries during interactions" (Bukamal, 2022, p. 345) could be reduced when the 'outsider' posed questions.

The authors' combined experiences have enabled an initial identification of cases to learn from and key figures to contact. The cases were pinpointed based on two factors, namely (1) their varying characteristics in number of collaborating universities, level of teaching and scale of collaboration; and (2) variations in type of educational platform to support the collaboration. Table 2 presents an overview of the selected cases and their respective characteristics.

Table 2 : Selected cases and their characteristics

Cases	Topic for collaboration	Level of teaching	Scale of collaboration	Number of partner universities
WASP-Ed	AI technology	Undergraduate, postgraduate level	National initiative (Sweden)	8 in collaboration (possibly 30+ as beneficiaries)
Math.se	Mathematics	Pre-university online courses	Regional collaboration, national outreach (Sweden)	2
SSES	Entrepreneurship	Postgraduate level	Regional initiative (Stockholm)	6
IDOCOS	Sustainability	Doctoral level	International initiative (European)	3 (+1 higher education company)
EIT InnoEnergy/ EIT Digital	Sustainable energy	Postgraduate level, Life-Long Learning	International initiative (European)	16
Unite! Metacampus	Innovation, technology, engineering	Undergraduate, postgraduate, doctoral level	International initiative (European)	9
ECIU	Innovation, technology, engineering	Undergraduate, postgraduate, doctoral level, Life-Long Learning	International initiative (European)	14

WASP-Ed, as described in the *Background and origin of study* section, is a national initiative to collaborate on AI education amongst potentially all higher education institutions in Sweden. It is funded by the Wallenberg foundation and targets both undergraduate and postgraduate education (WASP-Ed Homepage, 2024). The WASP-Ed collaboration is currently being set up and the choice of how to design the collaboration is yet unknown.

Math.se is a regional initiative between two universities in the Stockholm area. The collaboration has a national outreach with its massive open online courses (MOOC) in mathematics. Although managed by universities the level of teaching is pre-university, as preparation for university education (Math.se Homepage, 2024). Math.se relies on a digital education platform for online courses and has a homepage for information and applications.

Stockholm School of Entrepreneurship (SSES) is a regional initiative between six universities in the Stockholm area. The collaboration centers around entrepreneurship education on postgraduate level. SSES engages teachers from all participating universities and share a pool of students that have been

admitted to either of the collaborating universities (SSES Homepage, 2024). SSES has a homepage for marketing programs and courses as well as a procured digital, educational platform for teaching.

Innovative Doctoral Courses on Sustainability (IDOCOS) is a European initiative between three universities and one higher education company. IDOCOS collaborates on the creation and sharing of sustainability courses on doctoral level in an online and blended context. The collaboration is governed by a handbook for how to collaborate (IDOCOS Homepage, 2024).

EIT InnoEnergy is an initiative part of the European Institute of Innovation and Technology specifically focusing on sustainable energy. The collaboration has 16 partner universities throughout Europe and collaborate on postgraduate level and life-long learning (InnoEnergy Homepage, 2024). The collaboration anchors in a repository for where courses may be created and shared (InnoEnergy Repository, 2022).

Unite! Metacampus is a European initiative between nine partner universities. The focus of education is on innovation, technology and engineering at both undergraduate, postgraduate and doctoral levels. The metacampus is a digital platform that connects the collaborating universities in an online environment through which courses and programs are advertised and applied for (Unite! Metacampus, 2024).

European Consortium of Innovative Universities (ECIU) is an international initiative for businesses and cities to join forces with learners and researchers by collaborating on challenges. Students from 14 universities on undergraduate, postgraduate and doctoral level as well as life-long learning students earn microcredentials to work on and solve submitted challenges (ECIU Homepage, 2024).

Data collection

The collection of data was organized as a three-step process. First, the cases were studied in detail by reading up on written material, such as homepages, handbooks and reports. We searched for information regarding the characteristics of the collaboration in each case (see the column headings in Table 2). Moreover, we searched for descriptions of how each collaboration initiative was organized, what digital platforms were being used, analyses of how the collaboration was progressing, etc. The written material was used to map the cases on a spectrum from a collaboration mostly anchored in a digital educational platform, to a collaboration mostly built on shared processes and rules for organizing.

Secondly, meetings with representatives from the cases were scheduled. The representatives were identified by pinpointing individuals from various functions (such as IT, administration, and teaching) that had been, or still were, engaged in either of the identified cases. The meetings with representatives included both three roundtable discussions and one semi-structured individual interview with a director of Stockholm School of Entrepreneurship (SSES). Both the roundtable participants and the interviewee are referred to as respondents.

Thirdly, our tentative findings were presented and discussed at a WASP-Ed community event. This yearly program day gathers around 60-80 AI experts from both academia and industry in Sweden that share an interest in collaborating on AI education either at university or life-long learning level. During the community event project results are presented and actively discussed. The collaborative models resulting from our research were presented during one such community event. A group of around 15 people actively discussed and fortified the proposed models, as well as verifying the pinpointed challenge. The participants hold positions such as Chief Information Officer at a university and strategist at a large-scale industrialized company investing in life-long learning.

The reason for using several approaches was both to enable triangulation of data sources (Stake, 1995) and an ambition to answer two complementary research questions: The roundtable discussions aimed at gathering many individuals with different experiences and perspectives on setting up inter-organizational university collaborations. The respondents represented project coordinators, pedagogical experts, IT managers, education administration, etc. The aim was to pinpoint which trade-offs to make and what the consequences are of such trade-offs from many perspectives and roles, when setting up collaborations between universities (corresponding to RQ1).

The roundtable participants were asked to describe the collaboration initiative that they represented in terms of purpose, participating universities, topic for collaboration and how the collaboration was initiated. Furthermore, the respondents were asked to share experiences on challenges arising from how these collaborations were set up (corresponding to RQ2). The discussions revolved around the participants' perception of advantages and drawbacks with different ways of setting up collaborations between universities, the three proposed models, as well as if yet other alternative models could be identified.

The interview furthermore detailed our understanding of challenges in the intersection between collaborative processes and digital educational platforms by probing into how a digital educational platform becomes the frame for how the collaboration may be undertaken (corresponding to detailing RQ2). The interviewee was, similarly to the roundtable participants, asked to describe the collaboration initiative in terms of purpose, participating universities, topic for collaboration and how the collaboration was initiated. Moreover, the respondent was asked to describe the perceived benefits and challenges with how the collaboration was set up. The interviewee was also asked to show the digital educational tool used in the collaboration and to describe how they practically worked with and around the system in teaching and administration of education.

The WASP-Ed community event verified the outcome from the earlier steps. Table 3 presents an overview of which kind of material has been gathered for each case.

Table 3 : Data collection overview

Collaboration initiatives	**Written material**	**Meetings with respondents**
WASP-ED	Community event day notes, WASP-ED homepage (2024)	WASP-Ed community event
Math.se	Math.se homepage (2024)	Roundtable discussion 1
SSES	SSES homepage (2022)	Interview with a director
IDOCOS	IDOCOS Handbook (2022), IDOCOS Homepage (2024), IDOCOD Resport (2022)	Roundtable discussion 1
EIT InnoEnergy/EIT Digital	InnoEnergy homepage (2024), InnoEnergy Repository (2022)	Roundtable discussion 3
Unite!	Unite! metacampus (2024), Ebner et al. (2024)	Roundtable discussion 1, 3
ECIU	ECIU homepage (2024)	Roundtable discussion 2

The recommendation from our institution is to consider ethical approval on a case-by-case basis. In this instance, neither the topic of research nor the methodological approach meant collecting any sensitive personal data which is why ethical approval was deemed unnecessary (KTH Ethics, 2024). We have handled the collection of data as well as storage and use of empirical material, according to recommended procedures at our university.

The interview and first roundtable meeting were recorded and transcribed. The interviewee has reviewed and approved the use of the transcript for the purpose of this research paper. The SSES organization has several directors, which means that the respondent cannot easily be identified on the basis of this title. The interview conveys one example of how an inter-organizational university collaboration may be undertaken when it is up and running, and points to some advantages and drawbacks with how that specific collaboration is approached. Moreover, the interviewed director is an active teacher in the collaboration organization and thus had the possibility to convey how the design of the collaboration affects how the teaching work is done.

The material from the roundtables relies mostly on the researchers' notes about the cases and benefits and challenges from different perspectives/roles. The recording from the first roundtable discussions has been used to extend the notes taken during the meeting. No audio-recorded material has been gathered during the two latter roundtables, mainly for practical reasons: The quality of audio-material from the first roundtable was poor due to group discussions where many people speak (at times simultaneously) at times far away from the audio recording device.

The roundtable discussions have been undertaken on three separate occasions. During the collection of data several of the group's four researchers have partaken in each event, as such allowing for investigator triangulation. When several researchers look at the same phenomenon, this helps bring more detailed understanding about the cases and facilitates interpretations (Stake, 1995). Table 4 presents which respondents that were present during each session and what cases they represented.

Table 4 : Roundtable overview

	Duration (min)	**Respondents' position and university**	**Experience from**
Roundtable 1	120	Director of Resource Centre for Netbased Education, KTH	Math.se, IDOCOS
		Educational administrator & object specialist LMS, KTH	Canvas, LTI, internally developed LMS
		IT Business Analyst and project manager, KTH	Math.se, Canvas, PingPong (old LMS), internally developed LMS
		Lecturer in Learning in STEM and project coordinator, KTH	Unite!, IDOCOS
Roundtable 2	60	Chief Information Officer, Head of division, Linköping university	ECIU

		IT Architect, Linköping university	ECIU
Roundtable 3	75	Associate professor of Learning in Engineering Sciences, object owner for e-learning, KTH	Canvas
		Head of education office, KTH	EIT Digital/EIT InnoEnergy, Unite!

Data analysis

In general, the data analysis has focused on detailing and comparing the multiple cases, based on which approach they have had to setting up their inter-organizational university collaboration, as well as mapping which challenges they have claimed to encounter in their collaboration efforts. Although the analysis is rather a continuous endeavor of making interpretations that begin at no particular moment (Stake 1995), the process can be described in a first and second-level analysis.

As already mentioned, the cases were mapped from mostly a technical solution to mostly an organizational collaboration before the roundtables and interviews were conducted. This first mapping drastically simplified the cases, but yet they did not fit seamlessly into the spectrum. For instance, both Unite! Metacampus and InnoEnergy Repository have full-scale digital educational platform at their core, which meant categorizing them as mostly a technical solution. Yet they have very different digital educational platforms. Unite! Metacampus is a digital campus for students and teachers encompassing courses and common areas, whilst InnoEnergy Repository is a digital platform for teachers to create, share and find teaching material. Therefor the mapping was further developed by categorizing the cases into three kinds of collaborations, in the first step of the analysis. It is important to point out that this was not absolute or static categories, but rather generalizations to be able to present, compare and discuss the cases with the respondents. The categories resulting from the first step of data analysis were thus collaborations based on: (1) shared ways of working, (2) shared digital repository, and (3) shared learning management system (LMS). The categories are presented to the left in the data structure in Figure 2.

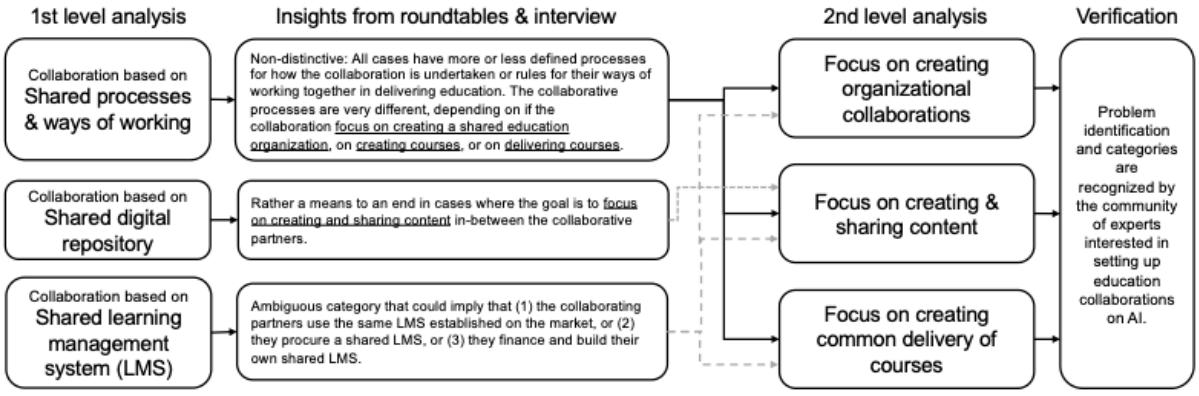

Figure 2 : Data structure showing the categories resulting from the first level analysis after having gathered written material, the added insights from the roundtables and interview, the three models resulting from the second level analysis, and the verification during WASP-Ed community event.

The first-level analysis was discussed both to verify and to adapt our categorization together with the respondents. Advantages and challenges with each of the categories were also deducted from the

empirical material. The input from the roundtable discussions and the interview were added to our analysis work as insights, as shown in Figure 2. Several weaknesses with the first categorization were identified by adding insights from the roundtables and the interview. The first category was non-distinctive, since all cases of collaborations had shared processes or ways of working, although these structures had different focus. The second category was rather a means to an end. For those cases where the collaboration focused on creating and sharing content having a shared digital repository was one way of achieving that. The third category was ambiguous since it could imply that collaborators were merely using the same learning management system (LMS), that they procured and used a shared LMS, or that they financed and built their own, shared LMS.

In the second level analysis, the three collaboration models emanating from this paper were formulated. These complemented one another better and the multiple cases could more easily be fitted into the categories. The baseline for the models was how the collaboration was initiated, that is, what the initial focus of the collaboration was and with that the consequences of such an approach. What became obvious in this step was that the studied cases were not static in time but rather had responded to some of the encountered challenges and changed over time.

Finally, the outcome of the second level analysis was verified by discussing it and receiving feedback on the problem statement and the three models at the WASP-Ed community event. The final categories are (1) Focus on creating organizational collaboration, (2) Focus on creating and sharing content, and (3) Focus on creating common delivery of courses. During the community event the three categories (i.e. the models for initiating collaborations) were acknowledged by the participants.

Models for approaching inter-organizational university collaborations

Based on the analysis of the data we present three models for setting up inter-organizational university collaborations for education, namely; (1) Focus on creating organizational collaboration, (2) Focus on creating and sharing content, and (3) Focus on creating common delivery of courses. These identified approaches to setting up educational collaborations in-between universities have been distinguished from studying multiple cases of initiatives to inter-organizational university collaborations.

Each model is first related to the perspective of setting up a new inter-organizational collaboration, using WASP-Ed as the example. Then each model is related to the other studied cases, that is, the established collaboration initiatives as part of the multiple case study. Finally, advantages and challenges with each model are presented.

Whilst the advantages should be part of the reason for choosing a model in the first place, the challenges are drawbacks that one will, or might, encounter when initiating a university collaboration following a chosen model. The models are not mutually exclusive approaches to setting up collaborations for teaching but may very well be combined. The models are rather an attempt to describe a focus or order of priority in what comes first.

Collaboration model 1: Focus on creating organizational collaboration

The first model is creating organizational collaborations by setting up common work processes for how the education collaboration should be conducted. This model does not entail having to set up a shared digital platform or repository but could be combined with such an approach. Since basically all universities have some form of digital educational platform in place (as shown in Figure 1) with supporting administrative processes and rules, it is also possible to rely on these and only focus on the processes for collaboration.

For WASP-Ed this option means that AI education at national level would be based on routines for *how* the collaboration should be conducted. Such process descriptions could include how students access the courses within the collaboration, how students are admitted, how the students' credentials

are reported, how the cost per credit and student is allocated, how new courses may be proposed, how the collaboration activities are followed up, how routes for decision-making are designed, etc.

Setting up a shared way of working would define which organization is responsible for which routines and processes in relation to courses or teaching modules. This means that the shared way of working must include enough degrees of freedom to be compatible with the routines, rules, and regulations at the many partaking universities. Following this model means that information, materials, students, and teachers still need to be added into technical platforms, but in doing so relies on existing infrastructure and processes at the different universities.

An example of this model in use is the *Innovative Doctoral Courses for Sustainability* (*IDOCOS*) initiative. The IDOCOS initiative (*IDOCOS Homepage*, 2024), is a European collaboration on doctoral courses in sustainability. The IDOCOS collaboration was initiated with a survey about the state of international collaboration on co-creation and sharing of doctoral courses, in Europe. The report based on this survey highlighted three relevant areas: *identifying key challenges to international co-creation and sharing*, *process related challenges*, and *digital supported platform* (Jensen et al., 2022).

First, the key challenges identified in the IDOCOS report include funding, internal rules, regulatory differences, time constraints, staff limitations, and adaptation to new work practices. On could argue that on a national perspective, differences might be less, but also nationally universities have different rules and regulations that complicate inter-organizational collaborations.

First, the key challenges identified in the IDOCOS report include funding, internal rules, regulatory differences, time constraints, staff limitations, and adaptation to new work practices. On could argue that on a national perspective, differences might be less, but also nationally universities have different rules and regulations that complicate inter-organizational collaborations.

Secondly, process-related challenges focused on course approval, stakeholder collaboration, and digital platform integration. In particular, two critical issues emerged: (1) clarifying and agreeing upon course approval, credits/degree, and program placement, and (2) effectively teaming up with stakeholders for co-creation and defining clear roles and responsibilities.

Thirdly, the report also highlighted the need for flexibility in digital platforms for effective international or inter-organizational collaboration (Jensen et al., 2022). Based on the challenges identified in the report, a shared framework was established and outlined in a handbook. This handbook serves as a guide for collaborative efforts in co-creating and sharing doctoral courses (Ampadu et al., 2022).

One would ideally choose this model for the benefit of being able to focus on the processes for collaboration, rather than building or procuring digital educational platforms. Setting up processes and governance for any kind of collaboration is a necessity for the cooperation to be functional. Moreover, most universities already have established processes for international student exchanges which could inspire setting up collaborations between universities also nationally, as such doubling as a process for national student exchanges (also outside the collaboration). If one manages to handle the matter of GDPR in relation to sharing data and analytics regarding student results, within the context of the collaboration such routines do not only benefit those active in the collaboration but could be spread throughout the universities as best practice. A summary of the advantages and drawbacks of model 1 is presented in Table 5.

Table 5 : Summary of advantages and challenges with model 1

Advantages	**Challenges**
Focus on collaboration rather than building or procuring digital platforms. Collaborative processes are necessary anyways, in order to create a smooth cooperation. Process for national student exchange. Routines for learning analytics will support all collaborating universities not only tied to the specific collaboration.	Poor visibility / branding compared to creating your own platform the students use for the course. Difficulties to see and measure the result of the investment. Requires many involved parties to set up this collaboration, including administrative support, IT-resources, and possibly faculty.

The challenges that this model encounter are three main drawbacks, shown in Table 5, whose significance partly depends on the ambition with the collaboration. Collaborations that focus on creating shared organizational processes, do not manifest in a digital platform to be shown and marketed. This leads to difficulties of seeing and measuring results from the investment in the collaboration, as well as poor visibility. Whether this is problematic partly depends on the financier's goal. Regardless of such goals, university collaborations often rely on students becoming aware of and applying for courses that are offered. Setting up an inter-organizational university collaboration by focusing on the collaboration organization require many involved parties from each university since both administrative processes, educational aspects and IT-matters need to be considered for the collaboration to become functional.

Collaboration model 2: Focus on creating and sharing content

The second model focuses on the creation and sharing of content, either entire courses or teaching modules, and the design of digital educational platforms to facilitate these efforts. For WASP-Ed, this approach would be centered on creating opportunities for AI educators at Swedish universities to collaboratively develop and share courses. Model 2 assumes that all universities already have digital platforms for hosting courses and sharing materials with students. However, it recognizes a gap in digital support for inter-university collaboration, where content sharing between teachers across institutions often is lacking.

Focusing on creating and sharing content is not uncommon in other national and international initiatives. It enables the sharing of educational content without the costs associated with developing, implementing, integrating, maintaining, and supporting a full LMS, such as Canvas. This model also allows for pedagogical flexibility, as it does not dictate the format or delivery of teaching. Universities retain control over the technical platforms they choose to procure, implement, maintain, and support.

One example of this approach is EIT InnoEnergy, an initiative designed to accelerate the energy transition by bringing together innovators, industry experts, students, and researchers (InnoEnergy Homepage, 2024). The EIT InnoEnergy consortium began by offering a joint master's program among its university partners. To further scale up the sharing of educational materials, it introduced an online repository where learning resources on sustainable energy were shared with all partners (InnoEnergy Repository, 2022). In addition, InnoEnergy developed guidelines for educators on how to use the repository and manage content rights.

In addition to developing structures for the creation and sharing of teaching materials, it's important to address the issue of navigating existing shared content. Duplication of similar content should be avoided, and systems should be designed to help educators efficiently locate and utilize shared materials. If creating new content is easier or faster than finding what one needs, the shared resource will likely be underutilized.

It is feasible to create a shared digital resource, such as a repository, to facilitate the development and sharing of courses. This repository could include a collection of courses, course elements, and other materials, with the goal of integrating these resources into universities' existing LMS platforms. The Learning Tools Interoperability (LTI) standard provides a well-established method for achieving this integration.

One would ideally choose this model because it enables easy sharing of teaching materials between academics from many universities, see Table 6. It also entails the possibility of creating visibility and branding of the collaboration to create awareness amongst students and others about the offer from the collaboration. This model is also advantageous in that it enables transparency and thus the possibility to overview content to identify what is missing or out-of-date. The model also enables research funding agencies to incentivize that the research advances are translated into accessible teaching materials for many. As such, a smaller investment in a shared repository may potentially create a large impact for the collaborating universities. This may be compared to the third model, which on average would be much more costly to realize.

Teaching in high-speed engineering education areas such as AI requires continuous updates of learning material. Creating smaller modules for courses and sharing these in a repository may be one way to keep the learning material up to date. Last, but not least, this model enables the continued use of the main learning management system that each university has already invested resources in (procurement, maintenance, support etc). For teachers this means not having to relearn another digital educational system. A summary of the advantages and drawbacks of model 2 is presented in Table 6.

However, there are some challenges to this model, as shown in Table 6. Historically, many repositories have seen limited success due to educators' reluctance to use others' materials, difficulties in finding relevant content, or insufficient quantity of available content. Many collaboration initiatives have prioritized the creation of repositories over the ongoing support and updates of the content.

A significant challenge within this model is establishing incentives and structures that encourage educators to develop and share teaching modules. Although academics should convert their research advances into teaching materials, it is not self-evident that extra time should be spent in uploading entire modules into repositories. As a prominent AI funding body, WASP has the potential to foster collaboration by requiring all funded research projects to contribute with shared teaching modules. This approach would ensure both the creation and utilization of high-quality educational resources within the repository.

Students may need to navigate multiple platforms for different courses, especially if they are enrolled at one university but taking a course delivered by another. This requires practical solutions for importing external students into a university's LMS and exporting credits after course completion.

Table 6 : Summary of advantages and challenges with model 2

Advantages	**Challenges**
Easy to share teaching material with other academics. Good visibility and branding possibilities for both the collaboration and the universities Funding agencies can incentivize analysis and development of content. Transparent: possible to overview content and identify content that is missing. Smaller investment can potentially create large national impact. Less resource intensive than model 3 Continuous updates of content are easily shared in a repository. Continue to use the main LMS that teachers/universities have already invested resources in.	Many repositories have had limited success. Necessary to structure who is to maintain and upkeep the repository. Incentives for both creating, sharing, and finding material must be set in place for this alternative to work. Students may have to swap systems when attending courses outside of the university they are admitted to.

Collaboration model 3: Focus on creating common delivery of courses

The third model focuses on creating common delivery of courses. In most cases, one would need to invest in a shared digital educational platform to deliver material and instructions in courses between geographically distributed universities.

In this third model WASP-Ed would create or procure its own digital educational platform to deliver the content of AI education created in WASP-Ed. Having a shared platform enables branding of the platform and of the distributed material, so that it is clear that this is part of WASP-Ed. From a WASP-Ed perspective, having a shared digital platform could thus be a clear manifestation of the work and investments done. Setting up a shared digital educational platform using an existing LMS solution (like Canvas, Blackboard or Moodle) for WASP-Ed education in Sweden would be a big endeavor. Given the student journey in Figure 1, the LMS needs to be integrated in the (complex) work process of a student's home university, in order to receive credits for a course.

For the teachers a new platform often means having to learn how to create and run courses in the new environment. Students are often quite adept at handling different platforms but might have a problem understanding *why* a course is using a different platform unless it is very well explained. Moreover, there is a continuous cost to consider, namely that of continuously working on several platforms in terms of teaching in, technically maintaining and supporting, as well as administratively keeping track of students. Other initiatives of adding a technical platform teach us about the challenge of making the change persist over time.

If choosing to create a common digital platform one must consider the level of ambition and willingness to bear costs; A shared digital platform could be anything from a modest solution that

simply facilitates sharing of material within courses, to an advanced solution that enables the creation of digital universities.

As an example, *Stockholm School of Entrepreneurship* (*SSES*) is an initiative to provide shared entrepreneurship education in the Stockholm region as a cooperation between 6 universities (SSES Homepage, 2024). The *SSES* organization has settled on a well-established shared platform, namely Canvas, where course material is shared in documents (such as pdf's), and links to films. The functionality used is thus much like a repository. In addition to this, it is possible to use the system for creating, submitting, and correcting assignments and for extracting basic educational data. Every course is created as university-internal courses, which means that it receives a local course code and an examiner per university (i.e., six course codes and examiners in total per course).

Having a shared platform for *SSES* means that the teachers must only create and share their teaching material through one channel. On the other hand, students and teachers alike must use dual platforms when considering a larger perspective, i.e. that they may have other courses in parallel. When it comes to administration, new students sign up for the course internally through their home university, and then must be added manually to the SSES educational platform. Likewise, the achieved credits and grades must be transferred back to their home universities and at times translated to the universities' various grading systems. SSES therefore has an employee with full access to all six universities' course registration systems who manually enters all results. Scaling such a solution to bigger volumes would be problematic to say the least.

Another example, on the other side of the scale, is the *University Network for Innovation, Technology and Engineering* (*Unite!*), which is a European Universities initiative (2024) with nine universities who collaborate on educational programs, virtual and physical mobility, innovative pedagogical methods, and harmonized governance models. The Unite! Metacampus is a digital platform that connects the nine universities of the alliance (Alcober & Mohammadali, 2023), to enable mobile access to the range of programs and diversity of activities that are offered (Unite! Metacampus, 2024).

At present the partner universities of Unite! can publish courses in the Metacampus, both for staff and students to participate in. There is ongoing pilot work on how to create a federated LMS through the use of LTI, that is, the standard for integration (Ebner et al., 2024). The project has been running for four years and was recently extended three more.

One would ideally choose this model because it unifies the delivery of education within the collaboration and creates possibilities for visibility and branding of the collaboration, as shown in Table 7. The common platform also enables teachers to overview what other teachers in the collaboration are educating on, in a course catalogue. Similarly, it is easy for students to recognize a course as belonging to the collaboration, given that it is delivered through the shared platform partly or in full (physical or digital lectures may still be provided through other channels). Yet, if a student only attends one course in the collaboration the value of recognition might be lost.

Setting up a shared delivery of courses through a digital educational platform also enables customization of the platform to the specific requirements of teaching in that subject. Last but not least, teachers may cooperate in delivering courses with colleagues from other universities in this model. A summary of these advantages as well as the drawbacks of model 3 is presented in Table 7.

Table 7 : Summary of advantages and challenges with model 3

Advantages	**Challenges**
Unifies the delivery of education within the collaboration. Great visibility and branding possibilities for collaboration organization. Easy for teachers to see what other teachers in the field are doing. Easy for students to recognize a course as belonging to the collaboration. Platform may be tailored specifically to the content of the education in the collaboration. Teachers can deliver courses with colleagues at other universities.	The universities partaking in the collaboration might get little visibility/branding. Very resource intensive technically and integration with other systems might be problematic. Administrative processes might be difficult to automate, thus requiring manual labor. Students might earn the right to apply for degrees from several universities. Creating one's own platform is costly and time consuming, resulting in a long period of time to deliver value. Teachers and students spend time on platform learning & use. Swapping systems: teachers and students work on multiple platforms.

This third model also entails a number of challenges to handle if choosing this model, as shown in Table 7. First of all, a shared delivery and digital educational platform might reduce visibility and branding opportunities for the partaking universities, since teaching is performed under the "collaboration flag". Investing in yet another digital platform is also technically resource intensive and integration with the existing systems at each university is challenging. In extension, this implies that administrative processes for importing students into the digital educational platform and exporting results to each student's home university might be difficult to automate, thus requiring manual labor.

Moreover, given the regulations for applying for degrees in Sweden, students may earn the right to apply for degrees from several of the collaborating universities: if students earn a specified number of credits from several universities they may apply for a diploma from each university. This also means that a student could potentially apply for and be admitted to a lower ranked university and then earn credits from another university through the collaboration, thus requiring the higher-ranked university to award a degree. These national rules and regulations matter for how the third model may be realized in practice and might mean that each collaborating university wants to have their own local course code, like in the SSES case.

If a collaboration initiative chooses to create it's own digital educational platform this takes time and is costly, which results in a long time before value realization. A new platform would also mean that users (students and teachers alike) would have to spend time on platform learning, instead of their core business of teaching and studying. If on the other hand, a collaboration initiative chooses to procure a commercial-off-the-shelf (COTS) solution this investment in time and resources is reduced. However, teachers and students still have to swap platforms for their education activities, depending on if it is part of the collaboration or not.

Conclusions and discussion

This research set out to explore approaches to creating and challenges with maintaining sustainable university collaborations with many participating higher education institutions. Our paper is a step in the direction of making more informed decisions on how to initially set up inter-organizational university collaborations in a more sustainable way, so that collaborations have the potential to outlast funding. To fulfill the purpose we asked (1) *How may educational collaborations be approached in-between universities?* and (2) *What challenges arise in the intersection between digital educational platforms and processes for collaboration?* By conducting a qualitative, multiple case study we have deducted three models for approaching inter-organizational university collaborations, in response to the first research question. We have also derived the inherent challenges with each model to answer the second research question. The three models and their challenges emerged from an iterative analysis of data collected from multiple sources, including written material, roundtable discussions, a semi-structured interview and a community event. The collection and analysis of data thus informed the formulation of the three models by revealing distinct patterns in collaboration strategies and highlighting key variables that impact their success.

One could claim that educational collaborations in-between universities may be approached in endless ways, in answering the first research question. New initiatives to create educational collaborations between universities appear continuously, with the intent to share scarce resources in specialized areas. What we have found however, is that educational collaborations between universities tend to follow either of three generalized models, which we present in this paper:

First, *focusing on creating organizational collaboration* implies initiating the collaboration based on shared processes that govern the collaboration. Secondly, *focusing on creating and sharing content* means approaching the collaboration by specifying how content can be created, shared and found, partly by specifying the technical interfaces to do so. Thirdly, *focusing on creating common delivery of courses* implies initiating collaborations based on a shared digital educational platform from which to provide teaching material to students from the collaborating universities.

The three models for collaboration differ when it comes to what is being "shared" and timeframes. In the first model, work processes for teaching and educational administration is being shared. In the second model, content for teaching is being shared. In the third model, delivery of courses is being shared. Regarding timeframes, the models differ both in time implementation, time for funding, and time for lifespan of collaboration.

What can be learned from the multiple cases is that *time* is an important aspect to consider. A risk is that collaboration initiatives fade out, run out of funding or never achieve momentum in the first place. Moreover, time matters for implementing the chosen collaboration model. For instance, all models are possible to apply when initiating the AI-focused national collaboration in Sweden, in line with the WASP-Ed ambition. The time needed to implement the different collaboration models does differ, however.

Focusing on creating and sharing content by procuring a repository and regulating how and what content is being shared might be a quick approach to get started. This model relies on the created and shared content being searched for and found, however. On the contrary, *focusing on creating organizational collaborations* by defining rules and responsibilities for the collaboration might be time consuming to set up, but once established could become a sustainable way of collaborating since teaching, administrative and IT-processes have been aligned.

When comparing the models to choose how to approach an inter-organizational university collaboration in education one should consider what the goal is. If the goal with an education collaboration is that the partaking universities continue to collaborate in teaching also after the funding has ended, one must consider what the long-term incentive structure should be and how resources can be allocated in the future. It is thus essential that the choice of path is chosen with the long-term

perspective in mind so that incentives for continued collaboration are embedded in the design of the collaboration.

In answer to the second research question, about what challenges arise in the intersection between digital educational platforms and the processes for collaboration, we find that all three models for inter-organizational collaborations have many advantages to motivate why they should be chosen but are also subject to several challenges, as summarized in Table 8.

By understanding the inherent challenges of each model, see Table 8, one may initiate inter-organizational university collaborations that are fit for purpose and that last over time. In the digital society we live in today, all universities have digital educational platforms that are used for sharing educational material between teachers or with students. When setting up collaborations in-between universities the choice of digital educational platform affects the processes for collaborating and vice-versa.

Table 8 : Summary of challenges with the three models

Model	Challenges
1. Focus on creating organizational collaboration	Poor visibility / branding compared to creating your own platform the students use for the course. Difficulties to see and measure the result of the investment. Requires many involved parties to set up this collaboration, including administrative support, IT-resources, and possibly faculty.
2. Focus on creating and sharing content	Many repositories have had limited success. Necessary to structure who is to maintain and upkeep the repository. Incentives for both creating, sharing, and finding material must be set in place for this alternative to work. Students may have to swap systems when attending courses outside of the university they are admitted to.
3. Focus on creating common delivery of courses	The universities partaking in the collaboration might get little visibility/branding. Very resource intensive technically and integration with other systems might be problematic. Administrative processes might be difficult to automate, thus requiring manual labor. Students might earn the right to apply for degrees from several universities. Creating one's own platform is costly and time consuming, resulting in a long period of time to deliver value. Teachers and students spend time on platform learning & use. Swapping systems: teachers and students work on multiple platforms.

As listed in Table 8 the first model is rather challenged by that it requires the cooperation from several functions at each university in addition to the teachers, which means that it might be time consuming, and that the collaboration may appear "behind the scenes". The second model on the other hand might seem straightforward at first but is challenged by its "deceptive look": upkeeping the sharing of content and possibly incentivizing the use of a repository is hard. The third model is challenging given the rules and regulations for admittance, crediting and awarding of degrees in Sweden. Yet if these challenges are solved the third model also encounters challenges in integration of administrative and technical aspects.

The challenges have culminated in a list of factors to consider when initiating a new educational collaboration. This list is presented in the practical implications below.

Practical implications

When creating inter-organizational university collaborations for engineering education, for instance in AI, it is very appealing to initiate such work with building the digital educational platform, for several reasons; Teachers and researchers concerned with AI and engineering education are often prone to favor technical solutions for one. Thereto the digital infrastructure is a tangible and straightforward outcome to show results. Yet, it seems that the main challenges of accomplishing scale in specialized education do not reside in which educational platform to choose.

Our research informs practice about several aspects to consider when initiating a new inter-organizational collaboration between universities. These aspects may be summarized as:

- **Funding organ's ambition and expectations**: What are the short-term expectations from the funding organ? What is the long-term ambition of the funding organ? Are these expectations and ambitions more or less compatible with either of the models?

- **Goal with collaboration:** when comparing the models for collaboration, it is advisable to take a step back and consider the overarching *ambition* with the new collaboration initiative. To collaborate on AI education nationally in Sweden, one may for instance ask: Is the ambition to establish WASP as first in mind when it comes to providing AI education in Sweden? Is the ambition to create a resource efficient way of providing AI education in Sweden, with WASP as the enabler? Is the ambition to enable AI researchers/teachers a forum to scale their teaching efforts and share best practice? Perhaps the ambition with the new collaboration initiative is something else, not just mentioned. Regardless of that, if the ambition comes first, it may provide guidance for weighing the models.

- **Collaboration format**: different scenarios for how the collaboration may be conceived should be considered, including the following questions: Should students from different universities, programs, and disciplines take part in the same or separate courses? Will program students' study with lifelong learning students? Will some teachers be content creators and other educators, or will the same person create and teach a course? Will one course be owned and administrated at one university, or will each course have a local course code and local administration? Will courses be online-only courses, MOOCs, or traditional physical lectures? How will new courses be created and who will make such decisions? Etc

- **Integration of digital educational platforms:** The choice of digital educational platforms should be informed by the goal with the collaboration and the chosen collaboration format. If, for instance, the ambition is to create a resource efficient way of providing AI education it becomes more important that the collaboration is seamlessly integrated into the ordinary systems – at least from a teaching and administrative perspective, which may differ from an IT-perspective since a seamless integration at the front-end might be resource intensive for IT in the back-end.

- **Maintenance:** both to how the chosen digital educational platforms, the teaching content and the processes for collaboration are to be maintained and updated should be considered. Guiding questions to consider this aspect may be: Who will make sure the collaboration is continued? Who will be responsible for technical updates and maintenance? How will updating the teaching content be incentivized? How will technical maintenance be funded and organized?

- **Participant perspectives:** the needs and demands of those that are to participate in the collaboration should be considered. The participants may be grouped into teachers, students (program and lifelong learning), administrators, and IT-personnel. One may ask: What are the incentives for teachers to create course content? What functionalities do teachers need and want for their teaching? How will students be made aware of, and how will they apply to, courses? What needs and wants do students have during ongoing courses? How will applications, admittance, and access to digital educational platforms be administrated? How will credits be assigned? How will IT support the administrative processes? What will be more or less costly in terms of how the collaboration is set up?

- **Authority and liability:** assigning ownership in the collaboration and decision-making in terms of who gets to decide what should be considered. Guiding questions include: Who may create a new course? How will a new course be created? Who will be allowed to apply for a course/program? How will credentials be awarded (from one or different universities)? How will credits be reported? Who decides when a course is to be discontinued?

- **Learning analytics:** the use of learning analytics in education is on the rise. With a collaboration between universities matters of GDPR rights surface might challenge the use of learning analytics. Establishing the intentions with using learning analytics should thus be part of weighing the alternative models. Such an intention could be to gather; (1) course data within a course which may be utilized for ongoing teaching and continuous course development; (2) metadata on an aggregated level that shows more the number of courses, modules, students etc. These intentions may in turn affect which collaborative model is best suited.

- **Collaborations with non-university organizations:** Lifelong learning is interesting for non-university organizations to keep their workforce up to date with the latest knowledge. Especially for new engineering subjects, such as AI education, industrialized companies are showing an interest in collaborating with universities to enable their employees to become lifelong learning students. This leads to several questions: Should lifelong learning students be given the possibility to benefit from the education in the collaboration initiative? How will such participation be enabled? (How) will non-university organizations be enabled to procure entire courses for many of their employees at once?

One could of course decide on a model directly, such as “we want to create a shared digital platform for all WASP-Ed courses in Sweden”, and then live with the consequences of such a decision. Or one could decide on an ambition, such as “we want to make AI education available at national scale in a resource efficient manner” and then pinpoint the route to reach that ambition by making informed decisions on the aspects listed above. Either way, the challenge of choosing a model to fit with the ambition of an educational collaboration – that is to weigh strategies, strengths, and weaknesses to meet an operational need – does not appear to be transitory but will persist over time.

Future research

The three models for educational collaborations identified in this paper have been derived from a qualitative, multiple case study of several cases with varying characteristics. These represent a snapshot of current collaborations, but there is a need to understand how these collaborations evolve over time. Future research could therefore explore the long-term success or challenges of inter-

organizational university collaborations, particularly how they scale and sustain over multiple years possible in a longitudinal case study.

We suggest that future research study the relation between the three models and different characteristics and across different contexts. Exploring aspects such as collaborations between different countries, different subjects, different university types in a comparative study could contribute to a more detailed understanding of how to achieve educational quality and organizational efficiency. One could for instance hypothesize that a *focus on creating common delivery of courses* is more suitable for large-scale initiatives with many partners that target undergraduate education. The rationale for such hypothesis being that common delivery, in terms of a digital educational platform, is a resource efficient way to teach many undergraduates, for instance through MOOCs. To fortify such a hypothesis, one would need to continue this research and study how the different models cater to different stakeholder needs and align with quality in education, for instance through mixed methods.

The study has been undertaken from the perspective of a Swedish, national context. This implies that we assume that the collaborating organizations abide to the same laws and regulations. Some of the studied cases are undertaken in an international context. We have then disregarded specific challenges of collaboration that stem from differences in laws, regulations, culture and language. What we have learned, however, is that setting up collaborations to pool students and teachers from many universities in Sweden seems to be a greater challenge than managing an international collaboration – partly due to rules for order of admission. This comparison is not included in this paper, but we call for further comparative case study research to verify such claims.

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References

Alcober, J., & Mohammadali, F. H. (2023). The digital platform for the Unite! Alliance: The Metacampus. *International Conference on Higher Education Advances*, 161–169. https://doi.org/10.4995/HEAd23.2023.16265

Ampadu, E., Keller, E., Titlestad, G., & Thorbjörnson, J. (2022). *Handbook for co-creation and sharing of doctoral courses - online and blended (v2)*. IDOCOS. https://idocos.eu/handbook,

Berends, H., & Sydow, J. (2019). Introduction: Process views on inter-organizational collaborations. In *Research in the Sociology of Organizations* (Vol. 64, pp. 1–10). Emerald Group Publishing Ltd. https://doi.org/10.1108/S0733-558X20190000064001

Boardman, P. C., & Corley, E. A. (2008). University research centers and the composition of research collaborations. *Research Policy*, *37*(5), 900–913. https://doi.org/10.1016/J.RESPOL.2008.01.012

Borrego, M., & Newswander, L. K. (2008). Characteristics of successful cross-disciplinary engineering education collaborations. *Journal of Engineering Education*, *97*(2), 123–134. https://doi.org/10.1002/j.2168-9830.2008.tb00962.x

Bruneel, J., D'Este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university-industry collaboration. *Research Policy*, *39*(7), 858–868. https://doi.org/10.1016/j.respol.2010.03.006

Bukamal, H. (2022). Deconstructing insider-outsider researcher positionality. *British Journal of Special Education*, *49*, 327–349. https://doi.org/10.1111/1467-8578.12426

Cricelli, L., & Grimaldi, M. (2010). Knowledge-based inter-organizational collaborations. *Journal of Knowledge Management*, *14*(3), 348–358. https://doi.org/10.1108/13673271011050094

Decuypere, M., Grimaldi, E., & Landri, P. (2021). Introduction: Critical studies of digital education platforms. *Critical Studies in Education*, *62*(1), 1–16. https://doi.org/10.1080/17508487.2020.1866050

Ebner, M., Gasplmayr, K., Hohla-Sejkora, K., Leitner, P., Edelsbrunner, S., Schön, S., & Taraghi, B. (2024, July). Federated virtual learning management in a European University alliance: General challenges and first experiences using LTI to connect LMS in Unite! *EdMedia2024*. https://www.researchgate.net/publication/382456053

ECIU homepage (2024). *About*, https://www.eciu.eu/member/eciu, date accessed 2024-06-25

EUA Briefings. (2018). *Universities and Sustainable Development Towards the global goals*. https://www.eua.eu/publications/briefings/universities-and-sustainable-development-towards-the-global-goals.html

European Universities initiative (2024). European Education Area: Quality education and training for all, https://education.ec.europa.eu/education-levels/higher-education/european-universities-initiative, date accessed 2024-09-09

Grimaldi, E., & Ball, S. J. (2021). Paradoxes of freedom. An archaeological analysis of educational online platform interfaces. *Critical Studies in Education*, *62*(1), 114–129. https://doi.org/10.1080/17508487.2020.1861043

Hill, Phil (2023). State of Higher Ed LMS Market for US and Canada: Year-End 2022 Edition, https://philonedtech.com/state-of-higher-ed-lms-market-for-us-and-canada-year-end-2022-edition/ , accessed 2024-03-15

IDOCOS Homepage. (2024). IDOCOS Homepage. https://idocos.eu/about

InnoEnergy Homepage (2024). *About*, https://www.innoenergy.com/about/about-eit-innoenergy/about-us/ , date accessed 2024-03-13

InnoEnergy Repository (2022). http://innoenergy.learnify.se/, date accessed 2022-12-01. Page closed.

Jensen, T., van't Land, H., Titlestad, G., Hansson, H., & Ekenberg, L. (2022). The state of international co-creation and sharing of doctoral courses in Europe. In *Report on the survey results within the framework of the Erasmus + project: Innovative Doctoral Courses for Sustainability (IDOCOS)*. https://idocos.eu/

Knobel, M., Patricia Simões, T., & Henrique de Brito Cruz, C. (2013). International collaborations between research universities: experiences and best practices. *Studies in Higher Education*, *38*(3), 405–424. https://doi.org/10.1080/03075079.2013.773793

KTH Ethics (2024). Checklist for legally required ethics reviews, latest access 2024-06-28

Lassi, M., Nauwerck, G., Winckler, A., & Cederberg, M. (2022). Visualising the digital transformation of research data management and student administration the Milky Way. *European Journal of Higher Education IT*, *1*.

Math.se Homepage (2024). *About*, https://www.sommarmatte.se/, date accessed 2024-03-13.

Nerlich, A. P., Soldner, J. L., & Millington, M. J. (2012). Inter-University Collaboration for Online Teaching Innovation: An Emerging Model. *Rehabilitation Research, Policy, and Education*, *26*(4), 321–344.

Romeu, T., Guitert, M., & Sangrà, A. (2015). Teacher collaboration network in Higher Education: reflective visions from praxis. *Innovations in Education and Teaching International*, *53*(6), 592–604. https://doi.org/10.1080/14703297.2015.1025807

Rouzbehani, R. (2020). Let's collaborate but how: Discussing collaboration barriers and opportunities in the digital era. *Canadian Public Administration*, *63*(4), 660–674. https://doi.org/10.1111/capa.12397

Rybnicek, R., & Königsgruber, · Roland. (2019). What makes industry-university collaboration succeed? A systematic review of the literature. *Journal of Business Economics*, *89*, 221–250. https://doi.org/10.1007/s11573-018-0916-6

Secules, S., Mccall, C., Joel, |, Mejia, A., Beebe, C., Masters, A. S., Sánchez-Peña, M. L., & Svyantek, M. (2021). *Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community*. https://doi.org/10.1002/jee.20377

SSES homepage (2024). *About us*, https://www.sses.se/about-us/, date accessed 2024-03-13.

SSES platform (2024). *Logga in*, https://sses.instructure.com/login/canvas, date accessed 2024-09-04

Stake, R. E. (1995). *The art of case study research*. Sage.

Stake, R. E. (2006). *Multiple Case Study Analysis*. Guilford Publications. http://ebookcentral.proquest.com/lib/kth/detail.action?docID=362572

Staley, D. J. (2019). *Alternative universities: Speculative design for innovation in higher education*. John Hopkins University Press.

Sunet (2022). Private correspondence e-mail, date 2022-09-14.

Talab, A. H., Scholten, V., & Van Beers, C. (2018). The Role of Universities in Inter-organizational Knowledge Collaborations. *Journal of Knowledge Economy*, *11*, 458–478. https://doi.org/10.1007/s13132-018-0545-x

Unite! Metacampus (2024). https://metacampus.unite-university.eu/, date accessed 2024-03-13.

van Dijck, J. (2018). Education. In J. van Dijck, T. Poell, & M. de Waal (Eds.), *The Platform Society* (Vol. 1, pp. 117–136). Oxford University Press. https://doi.org/10.1093/oso/9780190889760.003.0007

WASP homepage (2024). https://wasp-sweden.org/ date accessed 2024-06-24.

WASP-ED homepage (2024). https://wasp-ed.org/overview/ date accessed 2024-02-22.

Willcoxson, L., Kavanagh, M., & Cheung, L. (2011). Leading, managing and participating in inter-university teaching grant collaborations. *Higher Education Research & Development*, *30*(4), 533–548. https://doi.org/10.1080/07294360.2010.526095

Yazan, B. (2015). Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2015.2102

Yazici, E. B., & Özerbaş, M. A. (2021). The Analysis of the Efficiency of Digital Education Platforms Based on Various Variables. *Participatory Educational Research*, *9*(3), 383–402. https://doi.org/10.17275/per.22.72.9.3