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Empowering cross-disciplinary learning through online collaboration among students and faculty from Business English, Website Building, and Accessible Design Fields

Rita Koris
University of Applied Sciences, Hungary, koris.rita@uni-bge.hu

Zsuzsanna Palmer
Grand Valley State University, United States, palmerzs@gvsu.edu

Sushil Oswal
University of Washington, United States, oswal@u.washington.edu

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Abstract

Maximising students' creative potential to address contemporary issues and fostering cross-disciplinary learning are on the agenda of both top-down and bottom-up educational initiatives. Within the framework of research about cross-disciplinary learning and collaboration, this article argues for the capacity of cross-disciplinary online collaborations to prepare students for the complexity of working in today's interconnected, digital environment. The study presents the intricate curricular design of a cross-disciplinary collaboration project implemented by students and faculty at one European and two US universities. This multiyear project connects three university courses of different disciplines through virtual collaboration: Hungarian students in a business English course, students in Michigan preparing to engage in website building work, and students in Washington studying the field of accessible design. These three disparate disciplines are combined in a single project that integrates and applies discipline-specific knowledge acquired in each of the classes into a cross-disciplinary team assignments, where one team creates a website for the proposed business of another team with the help of accessibility advice from the third team. The analyses of student interactions from the third year of this ongoing collaboration and pre- and post-project surveys revealed that students demonstrated increased awareness of cross-disciplinary learning as well as improved effectiveness while collaborating to create cross-border solutions.

Practitioner Notes

1. Online collaboration projects provide a rich environment for cross-disciplinary learning.
2. Students and faculty connected by online collaboration projects can work towards the same goal while sharing their disciplinary knowledge with their collaborators.
3. While participating in cross-disciplinary activities, students enrich their disciplinary know-how.

Keywords

Cross-disciplinary learning, collaboration, accessibility, interaction design, client-provider relationship

Introduction

Maximising students' creative potential to address complex issues and fostering transdisciplinary learning are on the agenda of both top-down and bottom-up educational initiatives (Abegglen et al., 2020; European Commission, 2020; Gibbs, 2017; World Economic Forum, 2016). Connecting to existing research on cross-disciplinary collaborations (Cheikhrouhou and Marchewka, 2020; Evans, 2015; Engström et al., 2020; Fonseca et al., 2021; Koris et al., 2020; LaDuca et al., 2019; O'Dowd and Lewis, 2016; Štefl, 2019; Warr and West, 2020; Tai and Ting, 2020), this article argues for the capacity of cross-disciplinary virtual collaborations to prepare students for the complexity of the 21st century workplace and global citizenship. We define online cross-disciplinary collaborations as disciplines crossing international boundaries through collaboration among instructors teaching different curricula to students from more than one location. Envisioning cross-disciplinary collaborations in this mode opens up possibilities for individual instructors' disciplines being changed by boundary crossing through shared course goals; students sharing readings and work objectives; and student teams working on projects that are on one hand disciplinary – Business English students, for example, drafting entrepreneurial plans for European businesses – but on the other hand requiring cooperation and input from other teams from other disciplines in making these businesses accessible to all customers. By the virtue of how our project is designed to move between disciplines, institutions and across nations, it should be of interest to an international readership willing in expanding their knowledge beyond their own discipline and integrating social concerns in their pedagogy and curriculum. The pragmatics of our project's organisation and structure is a novel take on how to interlink geographically dispersed, cross-cultural courses for cultivating collaboration skills among students and faculty. Readers will especially find it useful how the units/modules/subjects can be redesigned for a collaboration of our kind to account for the project's movement.

Literature review: Innovative cross-disciplinary collaborations

Scholars and teachers have developed innovative online collaboration projects for research and teaching (Hagley and Wang, 2020; Satar, 2021). Examples of cross-disciplinary collaborations have been studied through different lenses in diverse settings. Some projects aim at improving higher educational teaching practices and pedagogies. Brazilian educators, for instance, have developed collaborations between global south and north while contributing their innovative pedagogies to global education (Almeida et al., 2019; Freire, 2018; Morosini et al., 2017). Hannon et al. (2018) have found that institutional processes, coordination, and curriculum practices are identified as primary barriers to cross-disciplinary education within the institution which can be surmounted in international, cross-disciplinary collaborations. International, cross-disciplinary learning projects which intrinsically require cross-institutional collaboration may eliminate these administrative barriers. Chase et al. (2017) report on the success of a cross-institutional, cross-disciplinary collegial collaboration aiming to reform digital assessment practices at Australian higher education. Likewise, Power and Handley (2019) claim that "cross-disciplinarity in common academic wisdom is best placed outside the disciplinary curriculum for a number of reasons, including shared ownership, reducing disciplinary barriers, and removing territorial boundaries of knowledge" (p. 568).

Other types of collaborations focus on students' learning, skills and competence development across disciplines and curricula. Salomão and da Silva (2020) promote students' cultural and language learning in tandem using the framework of the Global Competence Matrix to assess and develop students' intercultural communication skills. Although soft skills development and intercultural

communication competence are often difficult to measure (Hagley, 2020), Lenkaitis and Loranc-Paszylk (2021) have concluded that virtual exchange has an impact on global citizenship development. Schaffer et al. (2012) studied the self-efficacy for cross-disciplinary learning in project-based student engineering teams and their student data indicate mixed self-efficacy results in most of the variables considered important for improving team efficacy. Similarly, a group of researchers in China have organised collaborative research workshops for students to improve their scientific literacy and self-efficacy (Zhang et al., 2020). Contrary to Schaffer et al. (2012), their results reveal that "application of enactive mastery and vicarious learning strategies in research training workshop effectively boost students' motivation, confidence and feeling of accomplishment" (Zhang et al., 2020, p. 14).

Engström et al. (2020) argue for the development of cross-disciplinary project-based courses where students from various disciplines collaborate to accomplish shared project objectives. Stentoft (2017) places a problem-based approach at the centre of her investigation; however, she concludes that problem-based settings cannot guarantee cross-disciplinary learning. She calls for further research on cross-disciplinary learning and teaching to contribute to an ameliorated design of curriculum and better facilitation skills training for instructors. Our study challenges the pedagogical and curricular stalemates described by the above researchers and argues for project-based pedagogies that are the key to cross-disciplinary learning.

In this study, we describe a cross-disciplinary collaboration project and analyse results from our research to illustrate the tangible benefits to the students and favourable curricular results that this approach yielded. The study is based on a three-way collaboration project where students in Hungary propose a business and create an accompanying business plan for their company, students in Michigan design a website for this business, and students in Washington work as the advisors to both of these teams to make the proposed business and website accessible for the disabled (for a more detailed description of the collaboration project, see Palmer et al., 2020). Before presenting the quantitative and qualitative results we have gathered from the third year of this collaboration project, in the following sections we outline the three cross-disciplinary courses participating in this international collaboration and depict how their curricula have improved as a result of the interventional design of this project.

Pre-collaboration context

The strength of the project described in this article is that it connects courses from different disciplines through a collaboration design that requires the application of the expertise of students in their own disciplines and exchange this disciplinary knowledge with their cross-disciplinary student cohorts on other campuses while collaborating with one another. To illustrate the different curricular goals and disciplinary background of the three universities and to show the disciplinary boundaries that had to be forded, the ensuing sections outline the course curricula, main content and assignments of each course, and their respective learning objectives that the instructors included before they became a part of this cross-disciplinary collaboration project. In addition, it also describes each instructor's motivation for connecting their courses with collaboration partners.

English for business

The English for Business university course is part of the Hungarian students' specialised language course series which are an important and integral part of the International Studies curriculum. In the undergraduate programme, students learn two foreign languages: English as a compulsory first

language and another elective one. The aim of the English language module is to get students acquainted with specialised language after they have learned basic English – e.g., Business, Law, Economics, Politics, Diplomacy, and International Relations – that they need to use for their studies and later in their work environment. The English for Business course specifically focuses on the skills, terminology, functional language, and communication competence required to understand and discuss some of the key concepts in business and economics. The course sets out to give students an overview of the business ecosystem covering the most important areas of management, marketing, sales, procurement, logistics, production, finance, and accounting.

Before the English for Business course became a part of this cross-disciplinary collaboration project, students worked in class on a weekly business-related topic throughout the course. Each week they learnt the required terminology and linguistic components of the given topic and practiced business communication in mock business situations. This practice included both written and oral business communication in class through case-studies and take-home assignments. The course combined tasks which required both individual and group work. The assessment was based on their course participation, individual and group assignments, linguistic performance, mid-term and end-of-the-term in-class test results and overall development of communication skills. Although students achieved the learning outcomes of the course by working on the tasks and activities throughout the semester in this original course structure, it was traditional rather than innovative in design. New trends and developments in higher education with a move towards more collaborative, project-based learning, and a focus on international collaboration with native English-speaking classes provided a strong motivation to go beyond existing learning goals and design a new course curriculum which builds on project-based learning with international student cohorts. In the pre-collaboration context, students were not required to engage in experiential learning where they could take advantage of their creativity, collaboration skills, problem-solving and thus develop transversal skills in English. An increasing demand for 21st century skill development, internationalising of higher education curriculum and providing students with intercultural encounters during their studies (Jones, 2014-2021) resulted in seeking collaboration opportunities and partners across the Atlantic. Another aim of this partnership was to set up a cross-disciplinary collaboration and extend the horizon of students' learning. Finally, providing opportunities for Hungarian students to engage in meaningful linguistic interactions with native speakers of English was a further objective to start this collaboration.

Writing and designing for web development

In the Writing for the Web course, the main task of students within this collaboration project was to create accessible websites for proposed companies by the Hungarian groups. Since a website is such an essential part of a company's online presence in today's business environment, being able to create content and design corporate websites is an important skill in any programme focused on professional writing. Before the collaboration project described in this article, this course approached website design and content creation based on a fictional setup. Teams were tasked to describe a fictional company and create a lean business plan for this company that was then later used as the target organisation. While this approach works in general to teach basic design and web writing skills, there was little authentic urgency experienced, thus unmotivated students would sometimes modify the details of their fictional company to simplify the website creation process and undo the instructor's original learning objectives.

The motivation behind building this collaborative project from the point of view of the web design instructor was twofold. First, in today's globalised and networked work environment, it is important to expose students to intercultural experiences that will prepare them for their prospective

linguistically and culturally diverse workplaces. While internships and study abroad are an option, the cost of these programmes can often be prohibitive resulting in inequitable access. For this reason, online collaboration projects are an effective way for widening students' horizons when it comes to intercultural communication. The second motivation behind including students in a collaboration project is to improve their client-facing communication skills. To become successful web designers, students must be able to work with their own team members as they seek to understand their clients' specifications and expectations. Third, students must be able to effectively listen to their clients' problems and communicate the solutions they have designed and explain how these solutions align with the client's business goals.

Technical communication and accessible design

The content of Technical Communication courses at a university in Washington has shifted away from a heavy reliance on documentation design due to the rise of the web economy. These courses in the last two decades have developed curricula that prepare students for human-centred digital design, human-computer interaction (HCI), and socially aware designs. Accessible designs – both of built environments and web spaces – have thus gained prominence in these curricula. Students practice their theoretical design knowledge by taking up hands-on projects both on and off-campus. These are often labelled as service-learning projects and function as one-on-one gigs between a student and their sponsored internship site. These sites are generally local non-profit organisations with limited resources which welcome unpaid interns to fulfil their accessible web design needs. More recently, innovative design labs have been popping up in the South Sound area of Greater Seattle where entrepreneurial ventures of all sizes are flourishing. While these internship opportunities offer students real-world projects to practise their design learning, they also come with their problems: students' inability to deliver promised results due to limited cooperation from the sponsoring organisations in providing necessary information for the success of the design project, giving relevant and timely feedback, and poor relational fit between the student and the site manager. Most students expect greater involvement of the instructor in such internships which is neither feasible from the instructor's perspective, nor in line with the goals of such internships, which is the student's ability to work with the client autonomously.

Involvement in this international collaboration from the instructor's perspective offers the best of both worlds. While students do not struggle with the complications of negotiating with local internship sites in their otherwise busy lives, they nevertheless get an opportunity to work with their clients in Hungary and Michigan. The second advantage of this collaboration from students' perspective is the chance to work with two other student teams from the partner campuses and acquire first-hand experience of collaborating in a distributed team setting. The interaction among these cross-campus groups bears resemblance of real-world workplace experiences due to their client-provider relationships predetermined by the design of this faculty-driven project. Third, the student interactions within the campus groups, as well as, among the intercampus groups take place in digital spaces and faculty do not have to stretch their time resources to advise, arbitrate, and appreciate students' achievements and discords. Fourth, these student relationships stretch over state and national boundaries, giving them an opportunity to look beyond this northwest corner of the United States, experience intercultural environments of their distant peers, and observe their attitudes, approaches, and actions toward learning.

Collaboration context

Once the connections between the three instructors and their courses were established, each instructor had to restructure their courses and make changes to the deliverables assigned in each course. The following sections describe these changes at each collaboration site, illustrate the added topics and emphasise areas that were not only necessary for the collaboration project to work but also extended the original curriculum to allow students to benefit from cross-disciplinary learning.

English for business

Prior to the start of our collaboration, the learning goals of the English for Business course were revised. The pre-defined learning goals which targeted specific language learning related to Business were extended with further ones. The new learning outcomes included transversal skills development with special focus on collaboration skills, intercultural business communication, and digital competence. While the topical content of the course and the linguistic requirements remained unchanged in the syllabus, the pedagogical approach, how to teach content and language, was changed. A great emphasis was placed on experiential and project-based learning which relied mainly on intra- and inter-group collaboration. Students now work in teams on their start-up idea, and they develop a complete business plan for their venture by the end of the semester. By doing so, they need to apply business theory into practice and use the linguistic elements, terminology, and business communication patterns to write the project deliverables in English and communicate with their business partners, i.e., the partner student teams.

The development of their own business idea allows room for the students to unleash their creative potential and think 'out of the box.' The cross-disciplinary nature of the collaboration helps them understand other interrelated fields to business and teaches them how to communicate their ideas across disciplines. Students also learn to consider and appreciate concepts of other disciplines and incorporate these into their business plans. Besides their focus on business content and business English, students now need to learn how to work in global teams, how to collaborate online across various time-zones, how to organise their work, how to manage their team, and how to solve problems. They also need to use various online tools for asynchronous and synchronous collaboration, content management, and presentation.

In terms of course organisation, changes were also introduced due to the new collaborative context. The flipped classroom technique is now used to present background information, content, and linguistic elements. These are shared with the students before every class and serve as a prerequisite for classroom work. In class, students work on various sections of their business plan in small teams and engage in team and whole-class discussions on their weekly assignment and progress. Besides the class sessions, student teams also have the possibility to attend separate consultations with their tutor to ask questions and solve issues. The assessment of students' work includes both the individual and team assignments related to business planning, their language learning and performance, and their transversal skills development.

Writing for the web

Teaching web design as part of this collaboration project has influenced not only the course content but also the schedule and type of assignments students in Michigan worked on to complete the project. As the collaboration happens in an international context, more emphasis was placed on writing for global audiences, which became the focus of one of the weekly units. In addition,

students were asked to research Hungary, its language, customs, economy, and overall business environment to become more aware of their website's context and target audience. Intercultural communication strategies were also covered more intentionally in the courses where part of the collaboration project. To ensure that emails, meetings, and other contacts between teams at different locations are successful, several discussions focused on how to write effective emails and how to run meetings in online international contexts.

A pedagogical focus on communication strategies was especially important so that frequent emails between and among teams could facilitate a smooth work process. As web design students received advice and feedback from the Washington students about the accessibility aspects of their in-progress sites, they needed to ask clarifying questions to be able to implement the suggested changes that made their websites more accessible. To accommodate the request for content and visual design features of the Hungarian teams, timely, accurate, and polite correspondence was required. Modelling effective interactions as well as intervening and discussing miscommunication issues also became a common course topic throughout the duration of the collaborative project. While the ongoing communication efforts and the difference in time zones and course meeting times stretched the duration of the overall website design project, the added topics and skills covered during this time made it worthwhile for website design students to participate in this collaboration effort.

Technical communication and accessible design

Placing an accent on accessible design to resituate the course outcomes for this three-way collaboration among instructors and students, and to adapt course projects for this client-provider relationship, the Washington instructor not only had to develop new course assignments but also had to package them strategically in traditional technical communication genres, such as, information reports, advisory memos, and evaluation reports. These genres have been proven effective in simply communicating professional knowledge across distributed teams and are also compatible with the needs of accessible design contexts and content.

The revised course curriculum included a heavy dose of design theory; short lectures on disability and disabled users' rights and aspirations; and discussions of select trade and research articles on accessibility testing of websites, attitudinal and business barriers to building accessible websites, and benefits of constructing inclusive designs during the first half of the academic term (Oswal, 2013). This sophomore-level course thus transformed into a more advanced theory-based practice course with students shouldering the responsibility of acquiring accessible design know-how and then applying it to the business planning and website development situations while producing the deliverables for their clients in the form of informational, advisory, and evaluation documents. Of course, they also received instruction on traditional document design. During this period, these students also interacted with their distant peers according to the collaboration's design and the informational needs of the distributed teams. Additionally, they had the task of responding with substantive feedback to their clients' inquiries about accessibility problems confronted by them in their built environment and web design projects under development in Hungary and Michigan.

Aims and research questions

The current study focuses on the results of the third year of our pedagogical collaboration and longitudinal research project with the aim of mapping 1) students' discipline-specific knowledge acquired in each of the classes, and 2) their cross-disciplinary knowledge and skills developed

during the project experience. Therefore, this paper seeks to answer the following research questions:

1. What knowledge and skills did students perceive to have gained as a result of their participation in the online international collaboration project?
2. What evidence can be found for cross-disciplinary learning through this online international collaboration?
3. How do students perceive the overall benefit of cross-disciplinary learning?

Methods and participants

The study of the third year followed a mixed-method approach (Cohen et al., 2018; Creswell and Plano Clark, 2018) by combining quantitative and qualitative data collected from the students who participated in the third iteration of this collaboration project. While we have used this same approach for research and data analysis related to this longitudinal project in the first two years of our collaboration (Palmer et al., 2020; Oswal et al., 2021) we have altered the pre-and post-project surveys for this third year of the project. We decided to change the survey instrument precisely with the goal of focusing it on identifying specific areas of student-perceived cross-disciplinary learning.

The first iteration of our survey used in Year 1 and Year 2 consisted of questions that probed students' knowledge about the participating countries' business culture, business planning in general, and about website design, as well as sought to assess students' attitudes about collaboration and website accessibility before and after the project (for a detailed list of questions from the first two years see Palmer et al., 2020). While this approach helped us gain a better understanding of overall students learning and changed attitudes as a result of the project, we decided to gear our survey towards a focus on specific skills learned in this cross-disciplinary collaboration, as results of the first two years have shown the presence of cross-disciplinary learning but were not specific enough in pinpointing particular areas of student perceived learning. The main question used to assess cross-disciplinary learning in the first two years was question #5 shown below:

5. What knowledge and skills from the following list do you hope to (did you) gain from our intercultural project? Check the three most important ones.
   A. Improved foreign language skills.
   B. Improved practical communication skills across cultures.
   C. Improved knowledge about intercultural communication principles.
   D. Improved understanding of the business culture of the partner team's country.
   E. Improved knowledge about business planning, business functions and processes.
   F. Improved knowledge about effective website content and organisation.
   G. Improved knowledge about website accessibility.
   Other: please specify

The results to this question then were broken down based on students' university affiliation allowing us to see which groups improved skills outside of their course's main content areas. Additional questions focusing only on a specific area (such as business planning) were also added as seen below:

10. Now that the project is finished, what do you know about business planning? Check all that apply:

A. I know a lot more about entrepreneurship and starting up a business than at the beginning of the class.
B. I know a little bit more about entrepreneurship and starting up a business than at the beginning of the class.
C. I still don't know much about business planning.
D. Business planning is a completely new field for me.

However, due to the survey design, the skills learned were listed under a specific area implicitly suggesting that students should pay more attention to questions that directly relate to their own course's content.

For this third year of our study, our survey's major focus was on specific skills and knowledge areas (a list of 28 items in the questionnaire) to allow students to identify exactly what they learned as a result of the project and to help us determine exactly the content areas and skills where cross-disciplinary learning was made evident by the data. Also, the current iteration of the survey lists all skills and knowledge areas under just one question allowing students to select from any of the skills covered by the collaboration without implicitly suggesting that certain skills belong to certain courses. To illustrate how this detailed approach worked, Table 1 below shows how a more general skill and knowledge area on the first iteration of the survey was replaced by more specific skills and knowledge areas on the second survey.

Table 1: Comparison of survey questions between first and third (current) iteration of the survey

Sample knowledge and skills listed in first iteration of the survey under Question #5	Sample corresponding knowledge and skills broken down in the current iteration of the survey (full list of items and the survey questions are available upon request)
Improved knowledge about business planning, business functions and processes	E. Practical knowledge about business planning F. Knowledge about how a business can be made accessible for customers with disabilities G. Practical knowledge about how to run a business K. Coming up with creative business ideas, websites, solutions, etc.

As it can be seen in Table 1, the current iteration of the survey includes skills and knowledge areas that are much more refined and can help with better identifying the specific areas of learning indicated by students. The survey results were then triangulated with results from the qualitative data to determine even more refined aspects of cross-disciplinary learning.

Prior to conducting our research, the study has been reviewed by the institutional review boards of the two universities in the United States given exempt status. The study was also in compliance with the internal ethics protocol of the first author's university following Hungarian practice for academic scholarship. Participation in the study was voluntary and students were asked to sign a consent form.

Participants of the current sample consisted of undergraduate students at the three universities, however they came from various disciplinary backgrounds and academic majors. The Hungarian students were second-year undergraduate students majoring in international studies at a private university, the students in Michigan were writing and public relations majors at a state university

and enrolled in a web writing course. Washington students were enrolled in a technical communication course at a Research 1 state university and mostly came from technical and business majors. In all, 56 students enrolled in the three courses and participated in the online collaboration project: 21 students in the Hungarian class, 12 students in the Michigan class, and 23 students in the Washington class. The institutional distribution of the participants can be found in Table 2.

Table 2: Institutional distribution of participants

Participants	Pre-project survey number	Percentage	Post-project survey number	Percentage
Hungary	8	19	8	20
Michigan	11	26	10	24
Washington	23	55	23	56
Total (N)	42	100	41	100

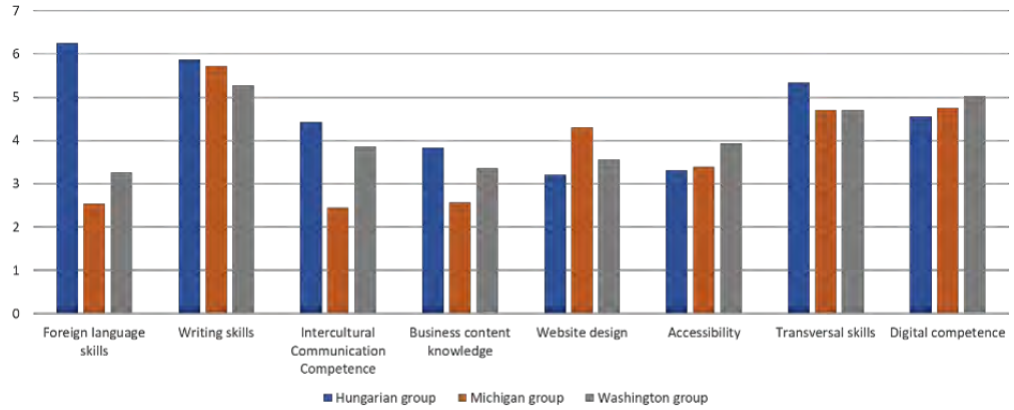
Both quantitative and qualitative data were collected by administering pre- and post-project online surveys, while further qualitative information was gathered from students through the analysis of student interactions and end-of-project reflections. 75% of the enrolled students agreed to take part in the research, thus 42 students responded to the pre-project survey and 41 answered the post-project survey. In the pre-project survey, students were asked to rate the level of knowledge and skills they thought they held at the start of the project to assess their existing cross-disciplinary knowledge. In this survey, they also provided their initial expectations of the project and described what knowledge and skills they hoped to develop during the project experience. In the post-project survey, students evaluated their perceived knowledge gain and skills development by rating a list of 28 items on a 7-point Likert scale (Finstad, 2010). The 28 items are displayed in the Appendix. Survey results were analysed in SPSS 25.0 for Windows, frequencies and descriptive statistics were used to report and interpret data. Data were evaluated separately for each university group with the aim of drawing conclusions for each cohort's cross-disciplinary learning. Other open-ended question items of the survey, students' interactions and reflections were analysed to identify recurring themes and patterns following the constant comparative method of qualitative research (Creswell, 2013).

Findings

Students' pre-project knowledge base and expectations of the collaboration project

In the pre-project survey, students were asked to mark their knowledge and skills they perceived to have prior to the project experience. 28 items listed various types of knowledge and skills which were associated with the following main categories: a) foreign language skills, b) writing skills, c) intercultural communication competence, d) business content knowledge, e) website design know-how, f) knowledge related to accessibility, g) transversal skills, h) digital competence. Mean average values were computed for all the above listed categories to determine the type of knowledge and skills each student cohort had. Pre-project survey results are summarised in Figure 1 and show the skills and abilities for students in each group where they indicated that their skills and abilities were the most developed.

Figure 1: Students' pre-project knowledge base (Mean average values of student responses)



The Hungarian group marked that their foreign language skills, their writing skills, and their transversal skills were the best going into the project. The Michigan group perceived that their writing skills, their digital competence, and their transversal skills were the best. The Washington group also rated their writing skills, digital competence, and transversal skills the highest. Students were more cautious to claim they had sound knowledge of the disciplinary content. Hungarian respondents marked that they had very little knowledge of business, accessibility inclusion, or website design. The Michigan group felt they have lack of experience in intercultural communication competence, business, and foreign language skills. The Washington group's knowledge gap was in foreign language skills, business content, and website design. The low level of foreign language skills in these last two groups can be explained by the lesser stress by many majors on learning foreign languages in higher education in the United States.

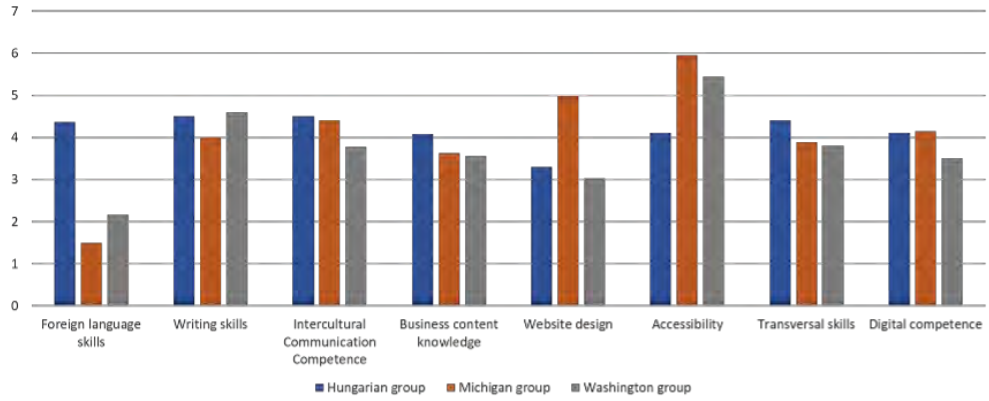
The comments on the pre-project survey regarding students' initial expectations about learning can also be grouped by their location. Hungarian students highlighted their openness to learning about the other cohort's disciplines and fields of study: "I am looking forward to working with students who study website design and are aware of (the needs of) disabled people because I think it is really important to provide those who have to live with disabilities with equal opportunities" (Hungarian student #5). Student groups in the United States emphasised the global perspectives that the three different groups can bring into the collaboration project (Michigan students #7 and #10, Washington students #6 and #21). These students also expressed their positive attitude to working in multicultural teams with students from a diverse cultural background (e.g., Michigan students #1, #2, #4, and #5, Washington students #5, #6, #13, and #16). Both the cohorts from the United States were looking forward to the collaboration as they perceived that it would enrich their employability skills (e.g., Michigan students #3 and #8, Washington students #3 and #7). These students also underlined that the international collaboration project would yield considerable advantages for their future work and career (Michigan student #8, Washington students #3, #7). Michigan student #8 explained: "This is real life experience I can use in my career." Similar thoughts were put forward by Washington student #13: "I believe this experience would resemble a working environment more than any other collaboration project that I have been part of and that will allow me the opportunities to learn and prepare for the future." Students – regardless of the university they belong to – hoped to gain transversal skills from the project experience, mainly leadership, teamwork, collaboration skills, and intercultural communication skills. They also expected to gain a better understanding of

the other disciplines: website design (Hungarian student #7, Washington students #12 and #15), accessibility (Michigan students #3 and #7, Hungarian students #1 and #5), business communication (Washington students #1, #3, #4).

Students' knowledge acquisition and skills development

The post-project survey also revealed differences by location when it comes to perceived learning (see Figure 2). Students in the Hungarian group perceived that their writing skills, intercultural skills, and transversal skills developed the most as a result of the project participation. They also believed that their foreign language proficiency and digital competence improved after the collaboration experience. Regarding the content knowledge, Hungarian students concluded that they gained considerable knowledge about disability and accessibility theories and about business studies, while somewhat improving their understanding of website design.

Figure 2: Students' knowledge acquisition and skills development (Mean average values of student responses)



Students in Michigan rated disability and accessibility and website design as the knowledge they gained the most out of the collaboration project. Then, they felt that their intercultural communication skills, their writing skills, their digital skills, and their transversal skills developed considerably. Students in the Michigan cohort perceived that they did not receive a deeper understanding of business. The top two categories that students in Washington marked high were disability and accessibility studies and writing skills. They also developed transversal skills, intercultural communication skills and digital competence. They felt that they had a somewhat better grasp of business-related concepts, however website design was not rated high in their knowledge gain perception ranking.

Students' perception of cross-disciplinary learning

Based on the students' answers to the open-ended questions and online interactions, their perceptions of cross-disciplinary learning can be summarised under the following four points. First, students believed that the collaboration project was a unique opportunity to learn about other disciplines that might not be directly related to their own field of study. As Hungarian student #1 explained: "Learning about disabilities, and how important it is to make everything more accessible. Because otherwise I don't think I would have learned about this somewhere else." Washington

student #7 was of similar opinion: "It's not an opportunity I'd get every day." Second, students (Hungarian student #5, Michigan student #7, Washington student #6) highlighted the importance of working together with students representing other countries, cultures, and disciplines, as it allows them to gain insights into culturally diverse perspectives. The third aspect of collaborative cross-disciplinary learning regards peer-to-peer learning. Students felt that they could rely on each other's competence and disciplinary content knowledge to come to a joint conclusion and complete the project successfully together. The following quotes demonstrate this aspect of the collaboration:

> *The fact that each group was specialised in a different aspect of the project made it so that it was not overwhelming to figure out.* (Michigan student #1)

> *The ability to work mostly independently from our intercultural partners, and only using their assistance to answer our questions.* (Michigan student #8)

> *I liked the idea of multiple groups working together to create a successful project.* (Michigan student #10)

> *I liked learning how other countries see business and how to prepare to create a business. Seeing a product develop over time is always cool to see and the improvements they made based on my feedback.* (Washington student #2)

> *I really appreciated the idea of the combined efforts toward one goal by all three groups, and how each group had their own specific part to play. I found the idea intriguing and I have never done a collaboration internationally before.* (Washington student #5)

Finally, the online collaboration project was like a reality game which simulated real work-life scenarios. Students appreciated the experience they had and the skills they developed which would prove to be a competitive advantage at their future work environment.

> *I really liked the collaboration between multiple teams in other areas because I think this is very applicable to real world situations where we would be asked to communicate with people across the world for our jobs.* (Michigan student #5)

> *Working with students outside of class makes the project appear like a real job task rather than just another school project.* (Washington student #1)

> *Working with other classes outside of the school (university in Washington) and being able to work in real-world scenarios of international collaboration. This is something that can improve my skill sets as well as add to my resume of skills exercised and experiences. This project is something more than just a grade, it is a necessary experience that can put me up one more than that other guy competing for a position in a business.* (Washington student #9)

Power of cross-disciplinary collaboration

The results from the quantitative and qualitative analysis show that students not only improved knowledge and skills in their own discipline but have also acquired cross-disciplinary knowledge through their involvement in this collaboration project. While all students have improved transversal skills that are necessary for effective workplace transition, they have also gained an understanding

of each other's disciplines; Hungarian students gained more insight into website design, and Washington students became more familiar with business concepts. Thanks to the revised survey design for the third year of our project, we were also able to determine the specific skills and knowledge areas where students perceived most of the improvement as a result of their participation in the collaboration. For example, writing skills and digital skills were among the skill areas where students indicated growth based on their work in this collaboration. Not surprisingly, all three groups increased their knowledge about accessibility which is not only a uniting element of this cross-disciplinary project work but also a defining thematic feature of our collaboration. We believe that having a thematic feature such as accessibility that in itself is an important area of societal and personal growth strengthened the cross-disciplinary learning of our students. Few international projects exist that meaningfully and authentically engage questions of equity and inclusion in their cross-disciplinary work (DeWinter and Klamer, 2021; Jiménez and Kressner, 2021; Watanabe, 2020). Contrary to the findings of Tange (2016), our cross-disciplinary project provided an inclusive knowledge practice for all participants involved in the collaboration.

Strengths and possible limitations

The main strength of this study is its simulated design as has been witnessed by students in all the three cohorts. However, the same may also be its primary limitation. While students do not work on projects in a traditional workplace, they experience the tensions of a typical workplace in managing time schedules, meeting deadlines, responding to client needs, and coming up with implementable solutions for their problems. The time difference in the three locations and the differing times when the autumn term starts on each campus also create complications of their own and limit the collaboration and video interaction opportunities for the three cohorts.

This collaboration project has some creative implications for design and business planning fields. Faculty across the Atlantic can design imaginative collaborations to engage their students in client-provider relationships to attain a wide range of disciplinary and professional ends while teaching their regular course curricula. Such collaborations not only break the monotony of a typical classroom, but also expands the curricula of participating courses as the participating instructors learn from one another and integrate the newly learned cross-disciplinary knowledge in their courses. Thus, it creates the chance for students from different geographical locations and contexts to work together on cross-disciplinary assignments. A second benefit of such a collaboration is that students are actors and agents in their own learning. Spurred on by their international peers, students are more motivated to meet their own class deadlines. Indeed, they exhort students to imbibe professional ethos in their group efforts and to always be alert to their clients' day-to-day needs to maintain healthy business and professional relationships.

Conclusion

This collaboration's design – where teams from three universities come together to accomplish their own course assignments while receiving and giving professional support to their two peer teams – creates a rigorous but also robust work environment that disrupts the humdrum of a typical classroom – instructor lectures, assignments, homework, and more homework. The instructors designing this collaboration have structured the workflow among these interlinked teams on the model of international distributed work groups coming together to achieve shared goals in one or more multinational organisations (Jordan and Adams, 2016; Nardi and Whittaker, 2002). The complex design of the collaboration promotes professional responsibility among student teams in the three locations. While participating in cross-disciplinary activities, students enrich their

disciplinary know-how. For instance, business English students develop businesses that serve all users and website designers take on the responsibility of reaching their audiences equitably and accessibly. Further on, the structure of the collaboration – which is founded on the principles of interdependence and shared responsibility – creates incentives for students to complete project work not only as class assignments for getting a grade, or course credit, but also as a desirable endeavour requiring personal investment and care.

The client-provider setup among each cohort of three teams from the three campuses shifts the focus of instructors' pedagogy from making motivational appeals to students about taking their assignments seriously to providing essential guidance about how to act in an accessibility-centred cross-disciplinary professional setting. Most students in these teams are already motivated to learn because this is their first opportunity to participate in an internationally distanced project with colleagues from other disciplines, but the complexity of the context also keeps them focused on day-to-day problem solving for their projects. Their substantive concerns dwell on what knowledge resources they need and from whom – the instructor, other teams, or class readings – to get the targeted work done and to attain the mutually agreed upon collaboration goals. Of course, they also have the day-to-day concerns about how to manage relationships and time zones to hold meetings and make deadlines. Implementing this innovative, cross-cultural, cross-institutional, and cross-disciplinary project involved some potentially very arduous organisational steps that instructors had to take to connect and redesign these courses. However, the value of the meaningful human-to-human engagements that we set up, and how sustaining, motivating and positive these are for our students. It is so much more than 'modelling' real life – it is real life.

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Appendix

List of 28 items referring to students' knowledge and skills to be gained as a result of their participation in the online collaboration project.

Items
A. Foreign language skills
B. Business communication skills
C. General writing skills
D. Intercultural communication skills
E. Practical knowledge about business planning
F. Knowledge about how a business can be made accessible for customers with disabilities
G. Practical knowledge about how to run a business
H. Knowledge about effective website structure
I. Practical knowledge how to create content for a website
J. Knowledge about how to make websites accessible for people with disabilities
K. Coming up with creative business ideas, websites, solutions, etc.
L. Building a website using software
M. Using ready-made templates available free on the internet to create websites
N. Knowledge about HTML and coding web pages
O. Skills to handle teamwork with my classmates
P. Collaboration skills with other teams from another university in or outside my country
Q. Leadership skills
R. Class presentation skills
S. Problem-solving skills
T. Negotiation skills
U. Conflict resolution skills
V. Interpersonal skills
W. Organizational skills
X. Time management skills

Y. Aptitude for learning to use new web applications for teamwork and collaboration with classmates

Z. Aptitude for learning to use new web applications for online communication and videoconferencing

AA. Aptitude for learning to use new web applications for writing reports and documentation

AB. Aptitude for learning to use new web applications for presentations