Human and Technology Mediation for Effective Blended Learning in Digital Higher Education

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Abstract—**Blended learning is a popular approach in higher education, but effective design and implementation by faculty remains a challenge that can impact the student experience. This research study explored how faculty can balance e-learning with face-to-face instruction to improve learning in a digital higher education environment. The conceptual framework articulated the constructs of blended learning and student support. Using an exploratory qualitative research method, the study examined two faculty members' course design and implementation for affective and cognitive student support in the context of digital technology at a business school in Montreal, Canada. Findings reveal strategies for innovative and situated technology-based instruction in blended learning to enhance the student experience. Limitations of the study and implications for future research in post-pandemic higher education are highlighted.**

Keywords—**blended learning, digital higher education, instructional design, student support**

I. INTRODUCTION

Digital higher education refers to the integration of digital technology in higher education institutions and encompasses a range of technological tools and resources used to facilitate teaching, learning, and research [1]. It involves the use of digital devices, software applications, online platforms, and other technologies to create a dynamic and interactive learning environment that supports student competence, engagement, and success [1]. Recent research supports the arguments on the importance of considering both the technical and social dimensions of technology mediated learning environments. For example, Liu *et al.* [2] found that the quality of social interactions in online discussion forums significantly influenced students' perceived learning outcomes. Similarly, Baltà-Salvador *et al.* [3] emphasized the need to consider the affective dimensions of e-learning environments, including students' emotions, attitudes, and motivation to enhance their experience.

In addition, recent studies have highlighted the importance of incorporating learner-centered approaches in the design of mediated e-learning environments. For instance, Zheng *et al.* [4] designed a learner-centered model that emphasizes the autonomy and motivation of online students, as well as the social and cultural context of their learning. Meanwhile, Truong [5] argued for the integration of adaptive learning technologies that can personalize the learning experience for individual students based on their needs and preferences.

Human mediation refers to the relational aspect of the e-learning environment, while technological mediation refers to the design of the content supported by Information and Communication Technology (ICT) tools [6]. This distinction is important because pedagogy is communication-based, and therefore the relational aspect of any ICT-supported learning environment must be considered. Human mediation must be intelligently integrated into the e-learning environment to enable interaction, exchange, negotiation, discussion, and empathy among participants. Annand [7] highlights the importance of social presence and interpersonal interaction in the design of e-learning environments, emphasizing the need to address the relational and affective aspects of learning in addition to the technological ones.

The integration of virtual solutions into face-to-face learning adds complexity to the human and technological mediation of instruction, but it can also improve student learning experiences and outcomes. Castro [8] has shown the potential benefits of blended learning, which combines online and face-to-face instruction, including improved student engagement, motivation, and achievement. However, the successful implementation of blended learning requires careful attention to the design of the learning environment, the integration of technology, and the facilitation of social interactions among learners.

Although higher education has been practicing blended learning for over 20 years, issues related to this instructional modality are more relevant than ever with the advent of COVID-19. Hodges *et al.* [9] have demonstrated the need for educators to adapt to the changing circumstances brought about by the pandemic, including the integration of online and face-to-face instruction, the use of technology to facilitate learning, and the development of new teaching strategies. Four years before the pandemic, as part of our doctoral research, we studied the impact of blended learning on the pedagogical competencies and professional identity development of two faculty members in an ICT-supported environment at a business school in Montreal, Quebec, Canada. The purpose of the current paper is to

describe how they designed and implemented the affective and cognitive support in their blended course to enhance their students' experience through digital technology.

The paper presents the background, conceptual framework, methodology, findings, and discussion of the research study, highlighting how the two faculty members grounded their use of digital technology in the realities of the blended course and the institution to design and implement innovative instructional strategies for affective and cognitive student support. It also acknowledges the limitations of the study and provides perspectives for future research.

II. RESEARCH BACKGROUND

The integration of technologies in higher education has been a framework for ongoing reflection on how universities can adapt to the digital age, in terms of institutional culture, organizational resources, and operationalization of research and teaching objectives [10, 11]. Bates and Sangra [12] as well as Garrison and Vaughan [13] emphasize the importance of considering the role of technology in higher education, and the need to adapt teaching practices to accommodate online and blended learning environments. In the mid-2000s, the School of Business (HEC) at the University of Montreal, Canada, added a blended learning delivery mode to its undergraduate certificate programs in the Department of Management to meet the new demand for higher education in the digital era. Our doctoral research investigated the impact of innovative technology-based teaching practices in blended learning on two instructors of the undergraduate certificate programs in the Department of Management at HEC during the winter semester of 2015 [14]. The thesis focused on how they articulated human and technology mediation to leverage e-learning in a blended instructional context.

Given the undeniable impact of technology in improving educational experiences, as highlighted by COVID-19 [9], the findings of our dissertation still provide good insights for the development of effective digital technology-based instructional strategies in blended learning today in 2023. In fact, after a long period of e-learning during the lockdown, blended learning is regaining popularity in the post-pandemic era due to its flexibility and adaptability to different teaching modes in higher education (on-campus, online, bimodal, and HyFlex courses) [15].

III. CONCEPTUAL FRAMEWORK

A. Blended Learning

The first key concept used in this study is Blended learning. It can be described as the integration of two or more modes of delivery, including face-to-face interaction, synchronous and/or asynchronous online learning, and self-directed learning. According to Garrison and Vaughan [14], there are three key constructs of blended learning: (1) the integration of online and face-to-face components (i.e., a seamless, single, unified learning environment); (2) a focus on interactions between learners, instructors, and content (i.e., meaningful, engaging, and collaborative interactions to promote learning); and (3) a flexible learning environment (i.e., a digital platform that allows learners to access content and resources when and where they need them). These constructs have been further developed and expanded upon in the blended learning literature.

For example, Graham [16] has proposed a framework for blended learning that includes seven principles: (1) design for active engagement; (2) access to resources and support; (3) design for content integrity; (4) design for assessment aligned with learning outcomes; (5) design for flexibility; (6) design for communication; (7) design for evaluation of the learning environment to achieve intended learning outcomes and improve instructional strategies. Picciano [17] argues for a multimodal model of blended learning that is purposeful, flexible, and adaptable to the needs of different learners and learning environments. It should include six types of instruction: (1) face-to-face instruction, (2) online instruction, (3) online collaboration, (4) independent study, (5) independent research, (6) experiential learning. Oliver and Trigwell [18] have shown that the effectiveness of blended learning depends on a range of factors, including the quality of teaching and learning, the relevance and coherence of the blend of delivery modes, and the alignment of the blend with learning objectives and outcomes: i.e., Blended learning is not inherently better or worse than other approaches to teaching and learning, but its effectiveness depends on how it is designed and implemented to support student learning.

B. Student Support: CoI and E-Moderating Models

The second key concept is twofold: i.e., Garrison *et al.*'s [19] Community of Inquiry (CoI) and Salmon's [20] E-Moderating model. CoI is a framework for understanding and improving e-learning in a blended course. Garrison *et al.* [19] identify three interdependent elements that are necessary for effective computer-based learning: (1) social presence (i.e., the degree to which learners feel connected and engaged with each other in a virtual learning environment, including social interaction such as sharing experiences, expressing emotions, and building relationships to foster a sense of community and active participation in online discussions), (2) cognitive presence (i.e., the degree to which students can construct and confirm meaning through sustained reflection; this includes critical thinking and inquiry to engage in meaningful discussion for deep learning and understanding), (3) teaching presence (i.e., designing, facilitating, and guiding online learning activities; this includes setting goals, creating assignments, providing feedback, and managing discussions to create a supportive and effective learning environment.

Salmon's [20] E-Moderating model is a framework for facilitating e-learning and interaction through effective moderation. It consists of five stages, each of which is designed to support and guide learners as they engage with content and interact with others in a virtual

environment: (1) Access and motivation (e.g., provide clear instructions, set expectations, and create a sense of community to foster a welcoming environment), (2) online socialization (e.g., use icebreakers, introductions and group tasks to build relationships among students and between students and instructor for social interaction and collaboration), (3) information sharing (e.g., use readings, lectures, videos and discussions to facilitate and guide the sharing of information and knowledge among students, (4) knowledge construction (e.g., use problem-solving, critical thinking or other tasks that require students to engage more deeply with content to apply and synthesize information as well as knowledge to create new understandings), (5) development (e.g., using reflection, self-assessment, or other tasks that help students to consolidate their learning and apply it in new contexts for knowledge integration and ongoing skill development).

C. Research Questions

Given the complexity of integrating virtual solutions with face-to-face learning to enhance the student experience, two specific questions guided the study:

- How does the instructor design the blended course to provide consistent online and face-to-face student support?
- How does the instructor implement the blended course design to achieve relevant student support?

IV. METHODOLOGY

A. Study Design

The study used an interpretive and exploratory qualitative research method, a comprehensive approach to examine and elicit relevant strategies for using technology to support learning in a blended course from the experiences of blended learning instructors. Given the specifics of blended learning within the same academic unit (specifics of instructors, students, academic disciplines, technology tools, and learning materials), the exploratory descriptive case study method was used to capture the specifics of each learning environment where instructors and students interact with and through technology to construct content and achieve learning outcomes. As Yin [21] argues, the boundaries between phenomenon and context are not clear. The realities of blended learning (phenomenon) cannot be understood without examining the experiences and environments of instructors (context). Thus, multiple sources of information are needed to deepen the understanding of the relationships between phenomenon and context to capture context-specific strategies for effective technology mediation to provide affective and cognitive support in blended learning.

B. Participants and Their Blended Learning Courses

To construct the cases, we asked ourselves who, where, when, and what situation we should select for the study within an academic unit where 13 instructors teach blended courses. This question led us to the theoretical sampling. The cases selected were not necessarily

representative of a statistical population, but rather had theoretical relevance to the purpose of the study: At least 2 years of teaching experience in blended learning. In fact, 1 year equals 3 teaching sessions (fall, winter, spring/summer), while 2 years equals 6 sessions. This gives participants enough experience to discuss and share about blended learning. When the ethics certificate was issued, an invitation letter and consent form were sent to all 13 instructors who teach blended courses. Only 2 of them responded despite several calls to increase the number of participants. Since we wanted to use analytic induction, the number of cases was less important than the distinctive characteristics we were looking for in each case. Therefore, we selected the two respondents as two different cases (Table I). We collected data from one course per instructor during the winter 2015 semester.

TABLE I. PARTICIPANTS CHARACTERISTICS

Case	Instructor	Gender	Exp.	Course Title
1	Full-time	Male	5 years	Sociology of work
2	Part-time	Female	2 years	Project management

TABLE II. INSTITUTIONAL SCHEDULING GUIDELINES FOR BLENDED COURSES AT HEC MONTREAL IN 2014–2015

Week	Instruction Mode
Week 1	Face-to-Face
Week 2	Face-to-Face
Week 3	Online
Week 4	Face-to-Face
Week 5	Online
Week 6	Face-to-Face
Week 7	Online
Week 8	Mid-term break
Week 9	Face-to-Face
Week 10	Online
Week 11	Face-to-Face
Week 12	Online
Week 13	Face-to-Face
Week 14	Online
Week 15	Face-to-Face

Sociology of Work (course code: 30-433-09 Z20) and Project Management (course code: 30-470-12 Z20) were two undergraduate courses offered as required or elective courses in the certificate programs. They were related to the logistics, management, accounting, marketing, and human resources programs. Both courses were offered in French and used a learning management system (i.e., *ZoneCours*) with an embedded synchronous e-learning platform (i.e., *Via*). *Via* is a web-based application with the same features as the latest video conferencing tools: whiteboard, chat board with file sharing, breakout rooms, screen sharing, annotation tools, emoticons, survey, and recorder. In addition, instructors could use a variety of digital tools online and/or face-to-face: e.g., podcast, blog, Articulate presenter, CmapTools, wiki, clicker for electronic voting, etc.). The institutional policy for the blended course schedule was as follows (Table II): The first two course sessions and the last course session were offered in a face-to-face format. The remaining course sessions alternated between synchronous and face-to-face activities during the 15 weeks of the semester. The 15

weeks included one week off. The class met 3 hours a week. The number of students in the sociology of work class was 67, and the number of students in the project management class was 31. The students in both courses were all working professionals. They were studying part-time.

C. Instruments and Data Collection

Course design: We examined the instructor's teaching philosophy, pedagogical strategies, choice of technology and consistency between the design of online and face-to-face sessions. This technique aimed to highlight how the instructor designed the course to balance online and face-to-face activities. It provided data to answer research question 1.

Video Elicitation Interview: We videotaped both online and face-to-face class sessions. We had the instructor reflect on video recordings of critical teaching moments, either online or face-to-face, to elicit the rationale behind the actions. This technique was used to show how the instructor implemented the blended course design to provide affective and cognitive support for learning. It helped to answer research question 2.

D. Data Processing and Analysis

We used analytic induction strategies with Nvivo (the qualitative data analysis software) to identify, organize, analyze, and interpret data for emerging relevant conceptual categories from the course outline, and video elicitation based on the recordings of online and face-to-face class interactions. We reviewed the transcripts and generated codes in search of emerging themes given the conceptual framework. We used descriptive coding to document and categorize the emerging themes. They were analyzed to construct meaning from the patterns of connections among them. We cross-referenced the two data collection instruments for triangulation purposes to ensure that we were effectively capturing the instructor's experiences and reflections from multiple perspectives. In addition, concurrent coding was used to check for regularities among the codes generated to ensure the validity and reliability of the patterns, relationships, and trends that emerged from the data.

This provided greater insight into the instructor's strategies for using technology to support students affectively and cognitively in the course. Since we wanted the evidence to reflect the conceptual categories designed, we paid attention to the instructor's subjectivity in relation to the observed data in the natural context of the learning environment, and the consistency with the observed facts, as well as the meanings attributed to them. The elaboration of conceptual categories is based on three key parameters that provide an adequate picture of what the phenomenon is, how and when it occurs (Fig. 1): the name of the phenomenon (tree), its characteristics (branch 1), its context of occurrence (branch 2). This process creates a tree structure rather than a simple three-branched topic tree. The structure becomes more complex as the analysis deepens. This led to categories that were common to both instructors, and categories that differentiated them.
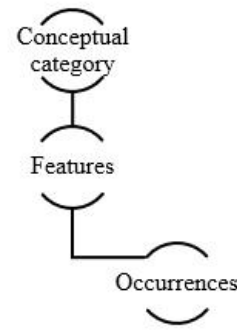

Fig. 1.   Structure of a conceptual category.

V.   RESULTS

A. Conceptual Categories Common to Both Cases

TABLE III.   COMMON CONCEPTUAL CATEGORIES

Case 1 – Sociology of work	Case 2 – Project management
Blended Learning Planning	Blended Learning Planning
Online class management	Online class management
Synchronous online multitask	Synchronous online multitask

Table III shows the same conceptual categories for both instructors in designing and implementing their blended courses: Blended learning planning, online class management, and synchronous online multitasking.

1) Category of blended learning planning
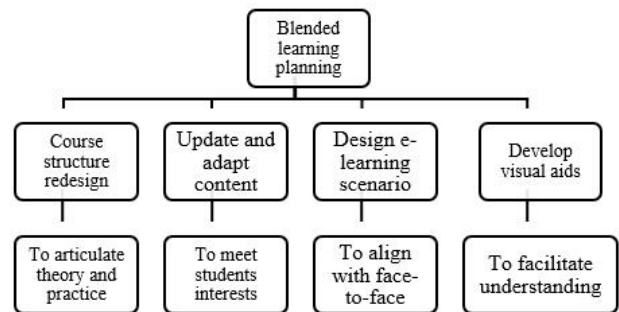This category refers to the lesson plan design activity:

Fig. 2.   Structure of blended learning planning.

2) Category of online class management
Both instructors see online class management as creating a virtual environment conducive to effective synchronous and asynchronous learning modes. However, this needs to be coordinated with face-to-face learning to provide students with adequate support in the learning process:
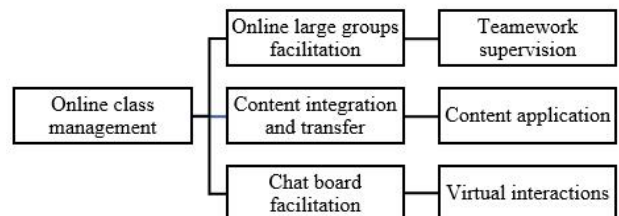

Fig. 3.   Structure of Online Class Management

3) Category of synchronous online multitask

The synchronous interactions of each instructor with the students indicate a series of simultaneous tasks that the instructor was trying to accomplish to establish a relationship with the students, focus their attention, and maintain the momentum of the course:
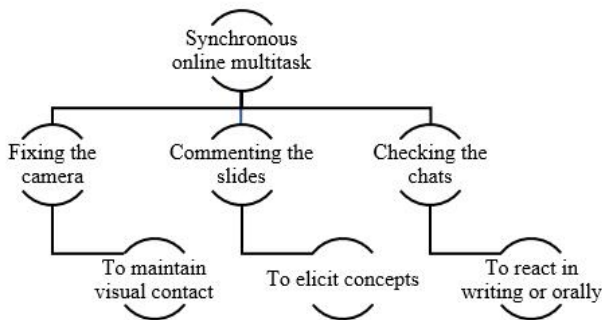

Fig. 4.   Structure of synchronous online multitask.

B.   Conceptual Categories Differentiating Each Case

TABLE IV. SPECIFIC CONCEPTUAL CATEGORIES

Case 1 – Sociology of work	Case 2 – Project management
Flipped bended class	Project-based blended class

Table IV shows the differences between their instructional approaches to implementing the blended course design: While the sociology of work instructor flips her blended class, the project management instructor uses a project-based blended class approach.

1)   Category of flipped blended class

This category grew out of the practice of the sociology of work instructor, who wanted a more dynamic way to actively engage students in both online and face-to-face learning. He turned to flipped pedagogy to maximize practice and social learning in face-to-face sessions, while alternating theory and practice through social learning in online sessions:
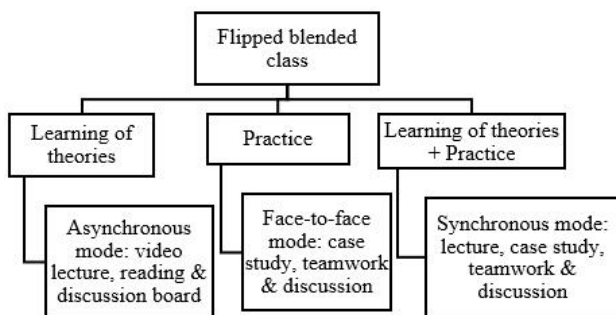

Fig. 5.   Structure of flipped blended class.

2)   Category of project-based blended class

This category emerged from the practice of the project management instructor. She redesigned the course structure based on the project management life cycle, using a metaphorical thread and mediated communication strategies to drive both online and face-to-face sessions to support students' comprehension and social learning:
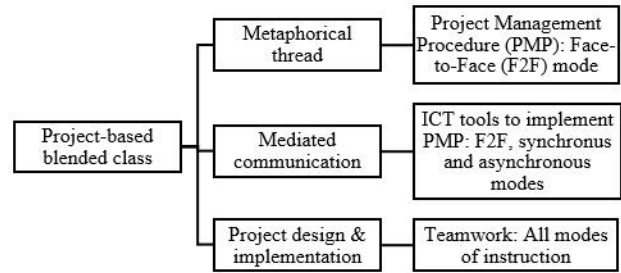

Fig. 6.   Structure of project-based blended class.

VI.   DISCUSSION

As can be seen, the instructional design skills in blended learning require consistent balance in implementing online and face-to-face components in the same course (Fig. 2). The blended course design and delivery of the two faculty members is embedded in a digital ecosystem, where students and instructors constantly interact with content through digital media to achieve learning outcomes. Teamwork is central to both instructors' strategies (Fig. 3), which is consistent with the CoI model [19]: their online class management strategies promote student socialization and the creation of an inclusive learning community through virtual and face-to-face interactions. In addition, visual tools are essential to student understanding and motivation in both blended courses. Both used visuals to support online and face-to-face instructional communication: e.g., maps, graphs, tables, symbols, illustrations, photos, and videos. These were digital tools provided by the institution to the instructors. As shown in Fig. 3, the two instructors' support for enhanced learning is exemplified in their online classroom management strategies.

Both instructors were found to implement their self-designed e-moderation strategy in online synchronous mode (Fig. 4). This online technology-based strategy is common to both. It involves multitasking, using online technologies to focus student attention and provide them with cognitive support. Both instructors' online nonverbal communication strategy is to use the computer's camera to make eye contact while presenting to the entire class. This underscores the fact that an instructor can be supportive and attentive online. No student can feel isolated. This creates an inclusive learning atmosphere with the instructor. Although both instructors did not use Salmon's [20] model, they e-moderated in ways that engaged students in the learning process: eye contact, teamwork, and chat facilitation to address students' written or oral questions. The result is a conversational e-learning process with technology that provides effective cognitive and affective learning support for students.

Both focus on interaction and motivation, key features of the blended learning frameworks of Garrison and Vaughan [13], Graham [16], and Picciano [17]. As evidenced by the specific structure of each instructor's class, human mediation strategies rely on the affective dimension (motivation) to establish a relationship with students and thereby focus their attention. In the flipped blended course (Fig. 5), the theory is learned

asynchronously online while the face-to-face sessions are hands-on workshops for knowledge transfer. The synchronous online portion of the course integrates both theory and practice to facilitate student comprehension. For the project-based blended course (Fig. 6), a thread is set in the first face-to-face session of the course to implement the project management process in both the online and face-to-face components. As can be seen, the connections between online and face-to-face learning strategies are central to each instructor's course design.

We can see that both instructors' innovative teaching strategies for implementing their blended course depended on their skills to balance both formats (Fig. 2) and their communication skills with digital technology to engage students through online learning (Figs. 3–6). This shows that the added value of a blended course is the flexibility that allows for off-campus learning [22], as students can access course materials and activities anytime, anywhere with an Internet connection.

VII. LIMITATIONS AND PROSPECTS

This research study has primarily examined the design and implementation of blended courses to support and enhance learning. However, it would also be relevant to examine the psychosocial dimension and emotional impact of blended learning on instructors as they engage in this type of course delivery. In addition, a larger sample size of the population is needed for a broader comprehensive comparative study within the same teaching area and with other areas. In a post-pandemic era in higher education, there are opportunities for collaborative research, using an iterative inquiry and pragmatic interpretive approach with blended course instructors. This will help cross-examine empirical and theoretical data to make sense of emerging blended instructional strategies that create frameworks for practice rooted in the course and institutional realities. This can provide greater insight into the rationale behind faculty innovative contextual practices and how they adapt to the dynamic evolution of the digital learning environment with emerging technologies in higher education.

VIII. CONCLUSION

The study shows the pedagogical agility and autonomy of the two instructors in constant interaction with the digital learning environment to meet the needs and expectations of their students. In other words, this case study highlights the pedagogical strategies and adaptations that instructors can develop given the realities of their blended course. However, there remains a need to explore its affective dimension and to engage in conversation with blended learning communities of practice to co-construct innovative disciplinary teaching strategies. We recommend embracing the pragmatic-interpretive side of digital higher education research to capture the complexity of blended learning and its connections to faculty professional development. Thus, a SoTL-based faculty professional development program should be designed to promote reflective practice and peer collaboration that integrates teaching and research to inform instructional innovations.

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