Redesigning MIS140: Business Data Communication and Networking through Active Learning

Final Report Submitted for the Probationary Faculty Development Grant

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Submitted to
Office of Academic Affairs
California State University, Sacramento
As part of the Probationary Faculty Development Grant
Spring 2025 Award Cycle

Date: June 16, 2025

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Abstract

This report presents the redesign of the MIS140 Business Data Communication and Networking course at California State University, Sacramento, to improve student engagement, knowledge retention, and educational equity. Recognizing the limitations of traditional lecture-based instruction, the redesigned MIS140 course integrates active learning strategies such as the Flipped Classroom, Project-Based Learning (PBL), Team-Based Learning (TBL), and Just-in-Time Teaching (JiTT). These methodologies transform the learning experience from passive to participatory, ensuring students actively construct knowledge while developing practical communication and networking skills.

A key innovation in this redesign is the proposal to split the current course into two sequential offerings: a foundational required course (MIS140) and an advanced elective (MIS1XX). MIS140 will be required for all MIS students, providing a shared foundation in essential networking concepts and communication skills. In contrast, MIS1XX will serve as an elective designed for students who wish to deepen their expertise through applied, project-based experiences and advanced topics. This tiered structure addresses both varying student preparedness and career aspirations.

Implementation during Spring 2025 included the use of interactive tools, collaborative activities, and formative assessments aligned with active learning principles. Early results suggest increased student engagement and comprehension. Future plans involve refining the course sequence, integrating more simulations, and launching MIS1XX by Fall 2026. This two-course design offers a scalable, equity-minded, and pedagogically sound model that aligns instructional strategies with diverse student needs and evolving industry demands.

1. Introduction

The Business Data Communication and Networking (MIS 140) course is a crucial component of the undergraduate curriculum in the Management Information Systems (MIS) program within the College of Business, designed to equip students with the fundamental knowledge and skills necessary for effective business communication in modern, data-driven environments. Traditionally, this course has relied heavily on lecture-based pedagogy, which has increasingly shown limitations in actively engaging students and developing practical competencies required in contemporary workplaces.

This course is primarily offered at universities within the MIS discipline, targeting business students, especially those pursuing careers that involve data communications, IT management, or related technical fields. At California State University, Sacramento, the MIS 140 course serves as a critical foundational course for business students aiming to excel in today's interconnected digital business environment.

Over the past few decades, the landscape of data communications and networking has undergone dramatic evolution. What was previously a specialized technical domain has expanded into a universally applicable skill set, pivotal for business professionals across various industries. As the complexity and scope of data communications have expanded, covering areas such as cloud computing, cybersecurity, big data analytics, and IoT, traditional lecture-based instructional approaches have struggled to adequately address the growing need for practical experience and hands-on understanding.

A crucial current issue in MIS 140 is educational equity. Students from diverse backgrounds, especially those historically underrepresented in technology fields, often face challenges in lecture-based environments due to disparities in prior knowledge, access to resources, and learning opportunities. Traditional teaching methods, which usually involve passive learning, inadvertently widen existing educational gaps, exacerbating issues of equity.

To address these two critical concerns, namely the widening landscape of data networking & communications domain, and educational equity, this course redesign project proposes splitting the current MIS140 course into two sequential courses: an introductory required course (MIS140) and a more advanced elective course (MIS1XX). This approach aims to provide more focused instruction, enabling students to gain foundational knowledge before progressing to advanced and complex aspects of data networking. The primary purpose of this redesign is to enhance student engagement, improve knowledge retention, and directly address

equity issues by ensuring that every student has sufficient support and opportunities for active participation.

Active learning methodologies, specifically Flipped Classroom, Project-Based Learning (PBL), Team-Based Learning (TBL), and Just-in-Time Teaching (JiTT), are central to this redesign. Active learning is particularly crucial because it encourages student participation, fosters a deeper understanding, and develops practical skills. By integrating active learning, students become active participants rather than passive listeners, thus promoting a more inclusive and equitable learning environment. This redesigned course structure actively seeks to bridge existing equity gaps by enabling all students, regardless of their background, to engage, participate, and succeed fully.

2. Literature Review

This literature review examines the theoretical foundations and practical applications of active learning methodologies in higher education, with a particular focus on their relevance to technical communication and business-related disciplines. It examines the benefits of active learning, various active learning techniques, student responses to these methods, and the role of technology in facilitating their implementation. Finally, it identifies potential gaps in the literature concerning the redesign of Business Data Communication courses using active learning.

2.1. Active Learning Methods

Active learning refers to any instructional method that engages students in the learning process, requiring them to do things and think about what they are doing (Alexander et al., 2010; Gonsar et al., 2021). Research indicates that teachers cannot simply transfer knowledge to students; rather, students must actively construct their own understanding by assimilating information (Barkley et al., 2014). Active learning promotes deeper understanding, increases retention of information, and enhances students' attitudes towards their studies (Johnson et al., 2021). It has gained significant attention as a practical pedagogical approach in higher education. This contrasts with passive learning, where students primarily receive information without significant engagement (Twigg, 2005). Compared to traditional passive lectures, active learning strategies encourage students to construct knowledge actively, leading to improved learning outcomes across various STEM disciplines (Hu, 2023). This is particularly crucial in fields where a deep understanding of complex concepts is essential. As Bonwell and Eison

(1991) articulated, active learning moves students away from a passive, note-taking role to an active, learning orientation. The emphasis is on students actively and skilfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information (Alexander et al., 2010). Meaningful and lasting learning occurs through personal, active engagement (Cohen et al., 2013) as active learning strategies enhance critical thinking skills by encouraging deeper contemplation of the material (Huxham, 2010). Furthermore, the best teaching fosters a sense of collaboration, where everyone is working together to understand and solve authentic problems (Bain, 2004).

Various techniques, including flipped classrooms, project-based learning, team-based learning, just-in-time teaching, reading circles, discussions, case studies, role-playing, fieldwork, and central projects, many of which involve collaboration, foster this active engagement. The key to successful active learning implementation is presenting students with authentic, intriguing questions and tasks, allowing them to make decisions, defend their choices, receive feedback, and revise their approaches (Bain, 2004).

The Flipped Classroom (FC) model exemplifies active learning by having students independently engage with new material outside of class through videos or readings, thereby freeing up classroom time for interactive activities such as problem-solving, discussions, and clarifications. Literature supports FC's effectiveness in enhancing knowledge acquisition and deeper material engagement, emphasizing the importance of carefully prepared teaching materials and participatory activities (Vdovinskienė, 2023). The integration of interactive tools like H5P within the FC framework further enhances student engagement and provides immediate feedback, bolstering student participation and understanding (Ashby et al., 2024; Wehling et al., 2021).

Project-Based Learning (PBL), another prominent active learning method, involves students in real-world projects or problems, typically in team settings, thus translating theoretical concepts into practical applications (Johnson et al., 2021). This method fosters deeper understanding and develops essential practical skills, particularly crucial in technical fields such as engineering and computing (Ismail et al., 2023). Studies comparing PBL to traditional instructional methods have found increased student engagement and motivation, affirming its effectiveness in improving learning outcomes (Pluskwik & Wang, 2020).

Team-Based Learning (TBL) similarly emphasizes both individual preparation and collaborative in-class activities. This learning strategy requires students to study new material before class and then engage in in-class activities in teams. Although predominantly discussed

within engineering contexts, its principles are adaptable across various technical disciplines (O'Connell, 2011).

Just-in-Time Teaching (JiTT) involves students completing short assignments before class, which instructors then use to tailor their teaching to address students' specific needs and difficulties. JiTT also proves effective by having students complete preparatory assignments prior to the class, which instructors subsequently use to customize instruction, directly addressing student needs and enhancing their performance (Gaddy & Medlock, 2013). A study in cell biology demonstrated the successful implementation of JiTT as an active learning pedagogy, leading to improved student performance (Gaddy & Medlock, 2013). Reading Circles Learning (RCL) is a collaborative approach where students read and discuss academic materials, taking responsibility for specific sections and sharing their understanding with peers. RCL further promotes active participation through structured peer discussions, where students take ownership of material and facilitate deeper learning (Hu, 2023). Different forms of RCL, including flipped versions incorporating audio presentations and visualization support, have been explored to promote deeper active learning (Hu, 2023).

2.2. Application of Active Learning in Technical Fields

The application of active learning in technical fields such as engineering and computer science has been a subject of considerable research. Studies have explored the effectiveness of FC in engineering graphics (Vdovinskienė, 2023), the use of PBL in digital systems design (Ismail et al., 2023), and the adaptation of TBL in electrical engineering (O'Connell, 2011). These studies often highlight the importance of hands-on activities and the need for instructors to carefully design learning experiences that encourage active participation and deeper learning. Students are encouraged to think critically, solve authentic problems, and develop vital teamwork and communication skills required in collaborative professional environments (Bain, 2004; Davidson & Major, 2014). Indeed, the "learning by doing" philosophy embedded in active learning aligns seamlessly with the hands-on nature of technical fields, ensuring students actively process information rather than passively receive it (Twigg, 2005). The integration of technology, including interactive tools and learning management systems, plays a significant role in supporting these active learning approaches in technical disciplines (Ashby et al., 2024; Visescu et al., 2023).

Moreover, active learning environments facilitate communication and feedback, critical for clarifying misunderstandings and encouraging further inquiry (Wieman, 2010). This ongoing engagement not only improves retention of information and problem-solving abilities

but also promotes connections between new knowledge and prior experiences, leading to more meaningful learning outcomes (Davidson & Major, 2014; Huxham, 2010). Thus, adopting active learning methodologies, supported by appropriate technological tools and instructional strategies, significantly enhances educational effectiveness, particularly within STEM and technical disciplines.

2.3. Student Responses to Active Learning

While the benefits of active learning are well-documented, understanding student responses to these methods is crucial for successful implementation. Some students may initially resist active learning due to their expectations of passive, lecture-based instruction. Concerns about the perceived value of activities, increased workload, lack of guidance, and logistical issues can contribute to negative responses. However, research suggests that negative student responses might be less prevalent than instructors fear (Pluskwik & Wang, 2020). Affective responses, such as preferences for different types of instruction or lack of enjoyment, are more commonly reported. Strategies such as clearly explaining the purpose of activities, relating them to learning outcomes, and providing adequate facilitation can help mitigate student resistance. Interestingly, studies have shown that both undergraduate and graduate students often desire a higher degree of active learning in their STEM classrooms than they currently experience (Shekhar et al., 2020).

2.4. Technology to Support Active Learning

Technology plays an increasingly important role in supporting active learning initiatives (Ashby et al., 2024). Interactive tools like H5P offer functionalities to create engaging learning experiences, such as interactive videos, quizzes, and self-assessment tests, which can be particularly valuable in implementing FC and other active learning strategies. Learning Management Systems (LMS) such as Canvas, Blackboard, and Moodle provide platforms for delivering learning materials, facilitating communication, and managing activities in active learning environments (Wehling et al., 2021). The thoughtful integration of technology can enhance student engagement and provide instructors with valuable insights into student understanding (Vdovinskienė, 2023).

2.5. Constructive Alignment

The principle of constructive alignment emphasizes the importance of aligning learning outcomes, teaching activities, and assessment methods to ensure that students actively

construct understanding that is relevant to the intended outcomes. Revisiting course design with a focus on functioning knowledge and aligning assessments with active learning verbs (analyze, design, identify, construct) can lead to more coherent and effective learning experiences (Ismail et al., 2023).

2.6. Gap in the Literature and Purpose of the Study

The importance of active learning in technical courses like data communications and networking cannot be overstated. While the literature extensively covers active learning in various STEM fields, a potential gap appears in the specific application and study of a comprehensive range of active learning methodologies in the context of Business Data Communication courses. These disciplines necessitate practical application of theoretical knowledge to real-world scenarios, with active learning techniques such as problem-based learning and case studies being particularly valuable. While technical communication and business education have explored active learning to some extent, the unique blend of technical and business concepts in a Business Data Communication course warrants specific investigation.

This paper aims to address this gap by exploring the redesign of a Business Data Communication course using a variety of active learning methodologies, drawing on the established benefits and implementation strategies discussed in the broader literature. By adapting and applying these principles to the specific disciplinary context of Business Data Communication, this study aims to contribute to more effective teaching and learning.

3. Methodology

To enhance student learning and engagement in Business Data Communication, the course will be restructured into two sequential modules, namely MIS140 and MIS1XX, each incorporating active learning methodologies tailored to their respective levels. MIS140, titled "Business Data Communication and Networking", a required course in the MIS program, examines the basic terminology, hardware/software components, network models (OSI and Internet), wired and wireless LANs, wide area networks, and basics of network design. One of the ways to enhance student engagement would be to utilize the Flipped Classroom approach, requiring students to complete pre-class readings, instructor-curated videos, and interactive quizzes hosted on H5P. These pre-class activities can be designed to establish foundational understanding and prepare students for in-class application (Vdovinskienė, 2023; Wehling et al., 2021). In-class sessions for MIS140, we can follow the Just-in-Time Teaching (JiTT)

model, whereby instructors analyze students' pre-class quiz responses to identify misconceptions and tailor instruction accordingly. These sessions emphasize guided discussions, problem-solving exercises, and case studies that deepen understanding and promote critical thinking. Interactive technologies, including simulations and drag-and-drop tools, can be employed to visually reinforce abstract concepts (Gaddy & Medlock, 2013). Additionally, structured Team-Based Learning (TBL) activities can be embedded, where students first respond individually to conceptual questions before engaging in peer discussions to reach consensus, thereby promoting deeper cognitive processing and collaborative learning (O'Connell, 2011).

The MIS1XX, "Advanced Business Data Communication and Networking," course is proposed as an elective for those interested in advancing their knowledge and skills in networking and communications. Building on the foundational knowledge from MIS140, this course focuses on the advanced, more complex, and practical application of data communication in real-world business contexts. While MIS140 will remain a required course for all MIS majors to ensure a foundational understanding, MIS1XX offers an opportunity for advanced learners to explore deeper, real-world applications in the networking domain. The core instructional strategy in MIS1XX will be Project-Based Learning (PBL), where students work in teams on a semester-long project addressing an authentic business communication challenge. The project can be divided into milestones to facilitate scaffolded learning, with regular feedback from instructors to support progress.

Class sessions in MIS1XX will be dedicated to lectures, discussing advanced networking concepts, project team meetings, collaborative problem-solving sessions, and case study analysis, all rooted in the principles of TBL. These sessions aim to sharpen students' decision-making and problem-solving skills within realistic scenarios. Peer reviews and team presentations are integral components, offering opportunities for reflection, constructive feedback, and the development of communication skills (Benton & Pallett, 2013).

Throughout both courses, instructors will adopt strategies to reduce student resistance to active learning. These include explaining the pedagogical rationale for each activity, setting clear expectations, and providing timely, formative feedback (Andrews et al., 2022; Tharayil et al., 2018). This dual-course structure ensures a progression from required foundational aspects of networking to optional advanced topics, aligning instructional methods with intended learning outcomes while addressing educational equity and engagement challenges. Both courses will include theoretical foundations where necessary and practical applications.

The redesigned Business Data Communication course (MIS 140 and MIS1XX) will integrate several active learning methodologies. In MIS140 (Introductory), we plan to employ the Flipped Classroom model. Students will engage with foundational concepts outside of class through resources like interactive H5P tools, preparing them for active in-class engagement. Class time will then focus on discussions and interactive exercises, allowing for deeper initial understanding. MIS1XX (Advanced) will utilize Project-Based Learning (PBL), where students will tackle real-world business communication challenges. This hands-on approach will allow them to acquire practical skills in analyzing and addressing actual business needs. Team-Based Learning (TBL) activities will also be integrated in MIS1XX to reinforce collaboration, teamwork, and problem-solving skills, which are essential for effective business communication and contribute to improved retention of key concepts.

These techniques are chosen to create natural critical learning environments where students learn by doing and confronting tasks they find relevant and engaging (Mueller & Oppenheimer, 2014). The focus will be on providing opportunities for students to make decisions, defend their choices, receive feedback, and learn from their experiences. The effectiveness of these active learning approaches will be supported by assessment methods closely aligned with the instructional methodologies.

4. Current Status and Future Direction

During Spring 2025, as part of my Professional Faculty Development Award, I attended the ACUE (Association of College and University Educators) course focused on evidence-based teaching practices. This intensive, semester-long training, which is structured like a graduate-level course, required weekly engagement through instructional modules, practical classroom implementations, and reflective writing. It provided a strong foundation in active learning pedagogies aligned with inclusive, student-centered teaching. The course fostered a community-based learning environment, encouraging collaboration and dialogue among faculty while allowing me to tailor research-based practices to the needs of MIS140 students.

Building on this foundation, I successfully implemented multiple active learning strategies in MIS140. These included peer-led fill-in-the-blank activities on IP addressing, the Jigsaw technique for LAN concepts, real-time formative assessments through Top Hat quizzes, and collaborative subnetting exercises that reinforced critical thinking. I also introduced structured note-taking guidance to enhance student study skills and plan to incorporate Fishbowl discussions in future semesters. The results were promising as students demonstrated higher engagement, improved comprehension, and greater participation. These efforts

underscore the importance of shifting from passive to active instructional approaches in technical courses.

Looking ahead, I intend to expand the use of active learning in MIS140 by integrating additional hands-on, application-oriented assignments and adopting visual aids and simulation tools to help students better grasp abstract networking concepts. I also intend to explore discipline-specific teaching technologies that support interactive and visual learning in data communications. Additionally, I plan to design the advanced course, MIS1XX, with a strong emphasis on project-based learning, thereby creating a well-structured learning progression across both foundational and advanced networking topics. The design and development of new courses require multiple levels of approval within the university's curriculum workflow system. I plan to develop and deliver the advanced networking course by Fall 2026.

5. Anticipated Results

The incorporation of active learning methodologies in MIS140 and MIS1XX is anticipated to yield several positive outcomes, supported by existing literature. These anticipated outcomes and related considerations are discussed below in a logical flow.

5.1. Enhanced Knowledge Acquisition

Implementing the Flipped Classroom model in MIS140, supported by interactive H5P tools, will facilitate a deeper initial understanding of fundamental concepts, thereby enhancing student readiness for active in-class engagement (Wehling et al., 2021). However, student resistance to this instructional shift must be anticipated and addressed proactively. Clearly communicating the pedagogical rationale and gradually introducing complexity through low-stakes activities can help mitigate resistance (Andrews et al., 2022; Tharayil et al., 2018).

5.2. Increased Student Engagement and Motivation

Active learning strategies employed in both courses—such as collaborative projects, interactive discussions, and engaging exercises—are expected to significantly boost student motivation and engagement compared to traditional passive lecturing methods. Specifically, Project-Based Learning (PBL) in MIS1XX, emphasizing real-world business communication challenges, is projected to further heighten student interest and participation. Nevertheless, instructors should be prepared for an initial increase in workload related to designing and facilitating active learning experiences (Pluskwik & Wang, 2020). Leveraging existing

resources, collaborating with instructional designers, and refining activities based on feedback can effectively manage instructor workload.

5.3. Development of Practical Skills

The hands-on nature of PBL in MIS1XX will enable students to acquire practical skills in analyzing and addressing real-world business communication needs. Concurrently, Team-Based Learning (TBL) activities will reinforce collaboration, teamwork, and problem-solving skills, leading to improved retention of key concepts. Effective facilitation by instructors is crucial to realizing these benefits; therefore, instructors should seek professional development opportunities focused on facilitating active learning experiences effectively (Chase et al., 2001; Nguyen et al., 2021).

5.4. Assessment Alignment

To maximize the effectiveness of active learning, assessment methods should be closely aligned with instructional methodologies. In MIS140, assessments should include evaluations of student participation in discussions and interactive exercises, in addition to traditional testing. In MIS1XX, the semester-long project will serve as the primary assessment vehicle, supported by clear rubrics and structured feedback processes to guide and evaluate student learning outcomes comprehensively (Brown, 2001).

6. Discussion

The primary purpose of this project is to redesign the Business Data Communication course to enhance student engagement, increase retention, and address educational equity by transitioning from passive lecture methods to active, participatory learning. The shift to active learning methodologies responds directly to evolving educational needs in technical disciplines, preparing students to effectively meet professional demands in an increasingly data-driven, interconnected business environment (Barkley et al., 2014).

The redesigned MIS140 course addresses critical pedagogical and equity challenges present in traditional lecture-based instruction. By integrating active learning methods such as Flipped Classroom, Project-Based Learning (PBL), Team-Based Learning (TBL), and Just-in-Time Teaching (JiTT), the course creates a more inclusive, student-centered environment that fosters deeper engagement and improved comprehension. This transformation is especially vital in technical subjects like data communications, where conceptual understanding and

applied skills are both necessary for academic and professional success (Barkley et al., 2014; Wehling et al., 2021).

A core strength of the redesign is the scaffolding created through the division into two sequential courses, namely MIS140 (introductory) and MIS1XX (advanced). This progression enables students from diverse academic backgrounds to first build foundational knowledge before tackling complex applications, thereby addressing disparities in prior exposure to technical concepts. Moreover, active learning practices promote collaborative peer interaction, which further supports students who might struggle in more traditional settings (Andrews et al., 2022; Ashby et al., 2024).

Additionally, the report emphasizes equity through structured activities, interactive technology tools like H5P, and low-stakes formative assessments, ensuring students of all backgrounds have equitable opportunities to engage, learn, and succeed. Overall, the redesign reflects current best practices in pedagogy and offers a sustainable model for technical education reform.

In summary, this redesign not only seeks to update and improve course delivery but also aims to cultivate a more equitable and effective educational experience for all students involved.

7. Limitations

Despite its strengths, the redesigned course has a few limitations. First, the implementation of active learning methodologies such as Flipped Classroom and PBL requires significant upfront planning, faculty training, and ongoing facilitation, which may strain instructional resources. Second, student resistance to non-traditional instructional methods remains a challenge, especially during the initial transition phases. Third, while interactive tools like H5P support engagement, technical issues and varied digital literacy among students may hinder their effectiveness. Lastly, the redesign's success is currently based on qualitative feedback and anticipated outcomes rather than longitudinal data or formal assessment studies, underscoring the need for future empirical evaluation.

8. Conclusion

The redesign of the Business Data Communication and Networking course into MIS 140 and MIS1XX, with the integration of active learning methodologies such as the Flipped

Classroom, Project-Based Learning, and Team-Based Learning, supported by visual aids, represents a significant pedagogical shift aimed at enhancing student learning and preparing them for the demands of the modern business environment. By moving away from traditional lecture-based instruction and actively engaging students in the learning process, this redesign is expected to foster deeper understanding, develop practical skills, increase motivation, and improve long-term retention. While challenges related to student resistance and instructor workload need to be addressed through careful planning, clear communication, and effective facilitation, the anticipated benefits of this active learning-focused curriculum hold the potential to significantly improve the educational experience and outcomes for students in Business Data Communication and Networking. Future research should focus on evaluating the effectiveness of these redesigned courses through student performance data, engagement metrics, and feedback surveys.

Acknowledgements

This report was developed with the support of the Probationary Faculty Development Grant awarded by the Office of Academic Affairs at California State University, Sacramento. I extend my sincere gratitude to the Diversity Awards Committee for recommending this project and to Provost Carlos Nevarez for approving the award. I also acknowledge the valuable assistance provided by Carly Yates and the Academic Affairs staff in facilitating the assigned time and funding. This support was instrumental in enabling the redesign of MIS140 to promote active learning and student engagement.

I would especially like to thank Varun Chillara, who was assigned as a student assistant for this project through the monetary grant of $500. His significant contributions to the development of both this report and the accompanying poster were critical to the successful completion of the project.

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