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Case Study on the Design of a Construction Management Course Implemented Through a University Co-Teaching Initiative with A Community College

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The construction industry in the US is projected to see tremendous growth in the coming decade. However, decreasing high school graduation rates may pose challenges in meeting the increasing demands for a qualified construction workforce. This underscores the need to strengthen the construction management (CM) education platforms across all higher education institutions to equip future graduates with the necessary knowledge and skills. This paper proposes a framework for a collaborative co-teaching model between a university and community colleges to enhance the articulation of the University's four-year Construction Management and the Community Colleges' two-year associate degree program. The co-teaching initiative aims to leverage the unique strengths and expertise of each institution to provide students with a comprehensive educational experience grounded in both theory and practice. The study employs a mixed methods approach, including quizzes, surveys, and direct observations, to evaluate the impact of the co-teaching model on student engagement, knowledge retention, and learning outcomes. The paper outlines the design, implementation procedures, and data analysis plans to assess the effectiveness of the collaborative approach. The framework provides a model for integrating industry trends, and diverse instructional perspectives to strengthen construction management education through university-community college collaborations. The study has implications for developing innovative pedagogies to prepare construction management graduates for the evolving real-world demands.

Key Words: Construction Workforce, Construction Management Education, Collaborative Co-Teaching, Innovative Pedagogies.

Introduction

Construction Management plays a crucial role in the successful execution of construction projects, ensuring their timely completion, cost-effectiveness, and adherence to quality standards. As the construction industry continues to evolve, it is essential for educational institutions to equip future construction professionals with the necessary knowledge and skills to meet industry demands. To achieve this goal, universities and community colleges have been exploring innovative approaches for course design and delivery, including co-teaching initiatives that leverage the expertise of both institutions. A co-teaching initiative between identified Higher Education Institutions (HEIs) could work to complement the U.S. Bureau of Labor

Statistics' projections which suggest a surge in construction employment, i.e., estimating an impressive 11.9 million jobs between the years 2020 and 2030, thus constituting 11% of the total expected openings across the US (Dubina et al., 2021).

Contrary to expectations, the projected decrease in high school graduation rates, as outlined by The Western Interstate Commission for Higher Education (WICHE), poses a significant challenge to the growth of construction jobs. The WICHE report emphasizes the potential disruption in higher education enrollment and, by extension, construction-related programs, given the projected decrease in the pool of high school graduates (Bransberger, 2017). Illustrated graphically in Figure 1, this study reveals a compelling inverse correlation: while employment is projected to increase (blue linear plot), high school graduation rates (orange curve) are simultaneously decreasing (Annor, 2022). The identified relationship carries potential implications for addressing challenges associated with the escalating demand for construction employment. Thus, targeted interventions are crucial to sustain the training of students in construction-related skills. The adoption of a co-teaching approach emerges as a viable solution, serving to not only bridge the existing skills gap but also furnishing students with more accessible pathways to enter the construction workforce. The collaborative efforts between the university and community colleges play a pivotal role in enhancing the articulation between the University's four-year degree program and the community colleges' two-year associate degree program. This collaborative approach facilitates a seamless transition for students, enabling them to progress from community colleges to university for a bachelor's degree while also equipping them for a smooth transition into the workforce.

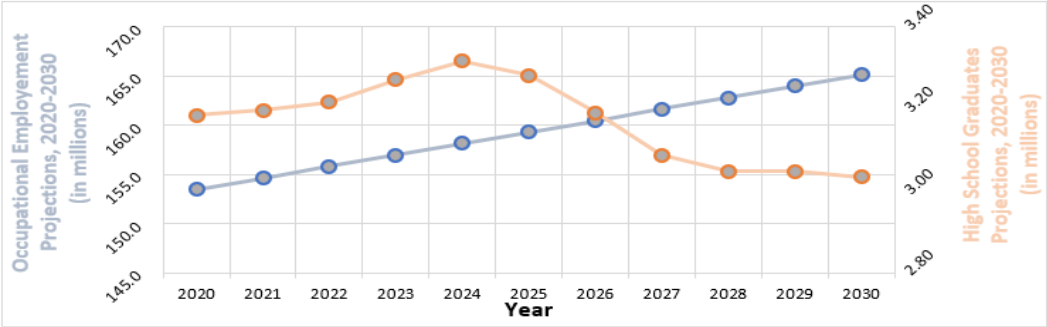

Figure 1. Projected Increase in Construction Workforce Vs. Projected Decline in High School Graduation, 2020 – 2030 (Annor, 2022)

The purpose of this paper is to propose a comprehensive framework for designing a construction management program articulation through a co-teaching initiative between the four-year university's program and the community colleges two-year program. This collaboration aims to maximize the strengths and resources of both institutions to provide students with a well-rounded and practical educational experience. The proposed co-teaching initiative involves faculty members from both the university and the community college, each contributing their expertise to the course. This collaborative approach allows students to benefit from the diverse perspectives and experiences of instructors from different educational backgrounds. Additionally, it provides students with exposure to the latest industry practices and techniques through guest lectures, site visits, and hands-on workshops.

The area of construction materials and methods has over the years witnessed significant evolution and innovation, crucial for the creation of resilient, safe, and high-quality structures. This transformation necessitates equipping future construction professionals with a profound understanding of the latest advancements to ensure the successful execution of construction projects. Consequently, a pivotal consideration in the instructional approach is ensuring a seamless transition for students as they progress from community college to the workforce or to the university. To address this, the integration of a collaborative teaching platform into the curriculum for construction management courses presents an

innovative strategy. This approach not only enhances traditional teaching methodologies but also effectively prepares students to engage with the real-world challenges encountered in the construction industry. Simultaneously, it offers students a bridge between the academic environment and the practical demands of the workforce and higher education.

Furthermore, the implementation of a co-teaching initiative emerges as a valuable tool to cultivate an educational environment characterized by collaboration, thereby stimulating active student engagement and participation. This collaborative learning approach encourages students to develop critical thinking, problem-solving abilities, and teamwork, which are highly sought-after skills in the workforce and academia. This perspective is supported by research findings from Gokhale, (1995) and DeMartino & Specht (2018). A central component of this pedagogical approach is the use of interactive activities. This tool not only enhances the comprehension of construction materials and methods but also provides students with an opportunity to apply their knowledge in authentic construction scenarios. The practical application of knowledge not only bridges the gap between theory and practice but also equips students with skills and experiences that are immensely valuable to potential employers, making their transition to the workforce seamless.

The significance of this research lies in its potential for students in both higher education institution levels to access the expertise of diverse instructors and to benefit from the strengths and resources of both a university and a community college. This co-teaching initiative offers a unique approach to preparing construction management students for the challenges of the industry. The proposed framework will not only contribute to the enhancement of construction management education but also serve as a model for other institutions seeking to establish effective partnerships and deliver comprehensive construction management programs.

In the following section, the paper will present a thorough literature review to support the proposed framework for designing a construction management course implemented through a co-teaching initiative between a university and a community college.

Literature Review

The integration of practical learning experiences into construction management (CM) curriculum has garnered increased attention in recent years as educators aim to better prepare students for careers in the construction industry (Jadallah et al., 2021; Wetzel & Farrow, 2023). A growing body of research underscores the need to bridge the gap between theoretical knowledge and practical skills to equip graduates with the abilities to tackle real-world construction problems. This literature review synthesizes key studies on the challenges in integrating university and community college teaching environments, strengthening practical education and collaborative teaching approaches in CM programs (see Figure 2).

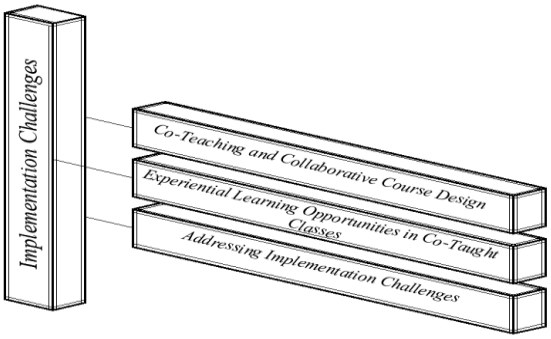

Figure 2. Literature Reviewed Framework

Challenges in Integrating University and Community College Teaching Environment

The integration of teaching environments between universities and community colleges poses several challenges that require careful consideration and thoughtful solutions. This integration, often referred to as articulation or transfer pathways, aims to create a more seamless transition for students moving from community colleges to universities (Stofer et al., 2021). Among the challenges encountered in this integration is the imperative need to ensure that the curriculum at community colleges align with the requirements of the university programs. Discrepancies in course content and prerequisites can hinder the smooth transfer of credits, potentially causing delays in students' progress (Giani, 2019), an addition to the obstacles created for students due to differing credit transfer policies between community colleges and universities. Some universities may not accept certain courses or credits earned at community colleges, leading to the need for students to retake courses, which can be time-consuming and costly. Students from community colleges may also face challenges in adapting to the different academic expectations, teaching methods, and campus cultures at universities (Wang, 2016). They may need additional support and resources to succeed in the new environment. Some students may have gained valuable knowledge and skills through work experience or military service, however, recognizing and evaluating this prior learning for academic credit is a challenge that institutions need to address.

Addressing these challenges requires collaboration between community colleges and universities, as well as ongoing efforts to streamline and improve the transfer process. Articulation agreements, improved advising, enhanced information dissemination, and resource allocation are key areas that can be targeted to facilitate a smoother transition for students moving between these two types of institutions. Additionally, a commitment to student success and a shared focus on educational outcomes can help overcome these challenges and create a more integrated and student-centered educational environment.

Co-Teaching and Collaborative Course Design

Collaborative learning has been widely recognized as an effective pedagogical approach in higher education. Studies by Scager et al. (2016); Mebert et al. (2020) have found that collaborative learning environments promote active student engagement, foster critical thinking skills, and enhance knowledge retention. Thus, the attempt for a convergence of expertise from both universities and community colleges shows promise in construction education. Co-teaching initiatives that leverage both university and community college faculty provide a means to integrate practical industry knowledge within a collaborative pedagogical framework. As a practice, team-teaching has been implemented to enhance curriculum design, expand evaluative feedback, and improve student engagement through varied instructional strategies (Dugan & Letterman, 2008; Harter & Jacobi, 2018). A good number of students appreciate and assimilate better how theories and concepts are shared and or argued differently through several unique perspectives by co-instructors to make meaning to them in the classroom (Harris & Harvey, 2000). Survey data indicate that co-teaching increases instructors' own professional growth and collaboration skills (Walters & Misra, 2013).

In construction education specifically, collaborative partnerships between technical-oriented community colleges and theory-focused universities allow students to gain well-rounded competencies. However, implementing a co-teaching initiative would require careful coordination between partners to develop a cohesive learning experience. A well thought out planning is required to bridge differences across institutional contexts (Mofield, 2020).

Experiential Learning Opportunities in Co-Taught Classes

Experiential learning opportunities within co-taught classes that bridge the gap between universities and community colleges offer a dynamic approach to education, with significant benefits for students. Such

opportunities have been studied in the context of these collaborative classes, and the research provides compelling evidence of their advantages. Co-taught classes, which bring together faculty from universities and community colleges, present an innovative platform for experiential learning opportunities. These collaborative initiatives aim to offer students a holistic and practical education, combining the strengths of both types of institutions. As evidenced by research, these opportunities provide students with a multifaceted learning experience.

The construction industry is dynamic, constantly evolving with advancements in materials, technologies, and methodologies. It is crucial for construction management programs to incorporate the industry trends and best practices into their curriculum. Along with the collaborative engagement, incorporating current industry developments into course content is critical for readiness. Experiential learning in co-taught classes equips students with practical skills that are highly valued in the workforce. A study by Kolb (1984) emphasize how this type of education bridges the gap between academic learning and real-world application, preparing students for successful careers. Therefore, emphasizing the need for more work in addressing collaborative teaching challenges.

Addressing Implementation Challenges

While promising, collaborative teaching approaches also pose challenges related to logistics and coordination (Mofield, 2020). Instructors may have differing teaching philosophies and expectations that can undermine consistency (Potts & Howard, 2011). Mofield (2020) recommends establishing transparent communication channels and regular meetings to align on a shared vision. Setting ground rules and responsibilities early on, helps mitigate issues in co-teaching initiatives (Walters & Misra, 2013).

Lastly, research clearly demonstrates the merits of incorporating practical learning, industry trends, and collaborative teaching approaches to strengthen construction management education. Experiential opportunities enable students to apply theoretical concepts, while building on collaborative engaging skills to ensure curriculum is responsive to contemporary techniques and issues. Co-teaching initiatives can leverage diverse expertise, but require coordination to address inconsistencies. Further research is warranted to develop best practices in collaborative course design and delivery models for construction programs.

Study Research Methodology

The research methodology employed in this study aims to gain a deeper understanding of the effectiveness and outcomes of a construction materials & methods course developed and executed through a collaborative co-teaching initiative between a university and a community college. By leveraging the strengths and expertise of both institutions, this innovative pedagogical approach offers a unique opportunity to enhance the learning experience for students in construction management education. The methodology is designed to investigate the various aspects of this co-teaching model, including its pedagogical approach, curriculum design, and assessment methods, to ascertain its impact on student engagement, knowledge retention, and overall learning outcomes. The various aspects of the co-teaching model is represented in a framework as shown in the figure below and is formed around the listed points shown.

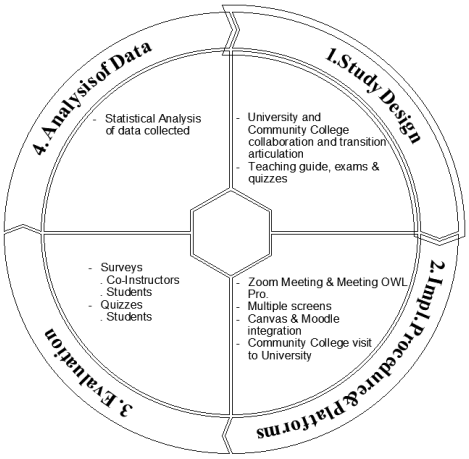

Figure 3. Framework Showing a Breakdown of the Pedagogical Approach, Curriculum Design, and Assessment Methods

The research employs a mixed methods approach to gather comprehensive quantitative data, encompassing the compilation and analysis of grades derived from quizzes and a comprehensive exam administered to students across both campuses. These quizzes offer valuable insights into the students' assimilation of content in the construction materials and methods course within the co-teaching environment, thereby highlighting the efficacy of the teaching model.

Complementing the assessment via quizzes, data was collected through surveys distributed to students enrolled in the construction materials and methods course, along with faculty members participating in the co-teaching initiative. Students were asked to provide insights into their engagement levels, satisfaction with the course, and perceptions of the co-teaching approach. Faculty members were encouraged to share their experiences in collaborative teaching, challenges faced, and the overall effectiveness of the initiative. The analysis of this quantitative data enables researchers to identify trends and patterns indicative of the co-teaching initiative's impact on students' academic progress.

Ultimately, this research methodology endeavors to contribute to the existing body of knowledge in construction management education and provide valuable insights for educators, administrators, and policymakers seeking to implement similar collaborative approaches to enhance the teaching and learning experience in across institutional modality platforms.

Study Design

University and Community College Collaboration and Transition Articulation:

A pivotal element in the successful execution of the co-teaching initiative lies in the establishment of robust collaboration between the university and community college. Instructors/Faculty members of record from both institutions actively engaged in collective efforts to cultivate a shared understanding of the course's objectives and outcomes. Through a series of regular meetings, a cohesive teaching approach was systematically developed, harmonizing with the unique strengths and expertise of each institution. This collaborative foundation, meticulously laid, serves as the cornerstone for creating a dynamic and enriching learning environment to benefit the students.

The formulation of the course curriculum itself was an outcome of this harmonious collaboration, wherein faculty members from both the university and community college contributed their expertise. This

cooperative endeavor seamlessly integrated their distinct perspectives, resulting in a curriculum meticulously crafted to blend theoretical concepts with practical applications in construction management. The curriculum, serving as a blueprint, delineates the course structure, learning objectives, covered topics, and the individual contributions of faculty members from each institution. This deliberate approach ensures the development of a comprehensive curriculum that imparts a well-rounded education to the students.

Teaching Guides and Exams & Quizzes:

The instructional materials, examinations, and quizzes were specifically designed to align with the co-teaching methodology. Faculty members worked collaboratively to create course materials, encompassing lecture notes, presentation slides, and supplementary resources, facilitating a cohesive co-teaching environment. Furthermore, an array of assessment tools, including one examination and 15 quiz sessions, were formulated to assess students' understanding and application of the course material. To guarantee equity and precision, faculty members from both institutions jointly developed these assessments, leveraging their expertise to construct a thorough evaluation framework. Importantly, the same examination content was administered uniformly across both institutions and concurrently. This approach aimed to uphold consistency and impartiality in evaluating students' academic performance.

Implementation Procedure and Platforms

The successful execution of the research methodology further relied on the seamless integration of various technological and educational tools to support data collection and facilitate the co-teaching initiative. The implementation phase also leveraged Zoom Meetings to foster efficient communication and real-time interactions between the university and community college faculty members, administrators, and students, ensuring that all stakeholders could actively participate and contribute to the co-teaching initiative, irrespective of their geographical locations.

The Meeting Owl Pro, a 360-degree smart conferencing camera, played a pivotal role in the implementation of the co-teaching initiative. The device was strategically placed within the physical classroom to capture the dynamics of collaborative teaching sessions, providing a holistic view of the interactions between university and community college faculty members and students. The Meeting Owl Pro not only facilitated live observation for researchers but also enabled the documentation of key moments in the co-teaching process.

To enhance the in-classroom experience, the implementation phase incorporated the use of multiple screens. In the physical classroom setting, students had access to various display screens, enabling them to engage with presentations, multimedia content, and collaborative activities simultaneously. This integration fostered a dynamic learning environment, enhancing student participation and reinforcing the benefits of the co-teaching model.

In parallel, the research implementation included the seamless integration of learning management systems, specifically Canvas and Moodle. These platforms served as the centralized hubs for course materials, assignments, quizzes, and grading. The integration of Canvas and Moodle allowed faculty members from both institutions to share and manage course content efficiently. This streamlined approach eliminated redundancies in course administration and ensured a consistent experience for all students, irrespective of their home institution.

The integrated use of Zoom Meetings, multiple screens in the classroom, and learning management systems such as Canvas and Moodle ensured a cohesive and efficient implementation of the co-teaching initiative. By harnessing these technological and educational tools, the research team successfully captured a comprehensive understanding of the impact and effectiveness of the collaborative teaching model on the construction materials and methods course. The seamless integration of these tools contributed to the

research's credibility, as it facilitated the collection of rich data and provides valuable insights into the potential benefits and challenges of co-teaching initiatives in higher education.

Evaluation & Analysis of Data

The research methodology included a comprehensive evaluation process, incorporating surveys administered to all participants across both campuses and the analysis of exams and quizzes to assess the impact of the co-teaching initiative on the construction materials and methods course between the university and community college.

Analysis of Exams & Quizzes:

The examinations and quizzes were meticulously crafted to evaluate students' comprehension and mastery of the course materials, with careful consideration given to their alignment with the course objectives and overall curriculum design. A total of 15 chapter quizzes and one comprehensive exam were administered throughout the assessment period. Figure 4 depicts the mean grades achieved by students across both university and community college campuses.

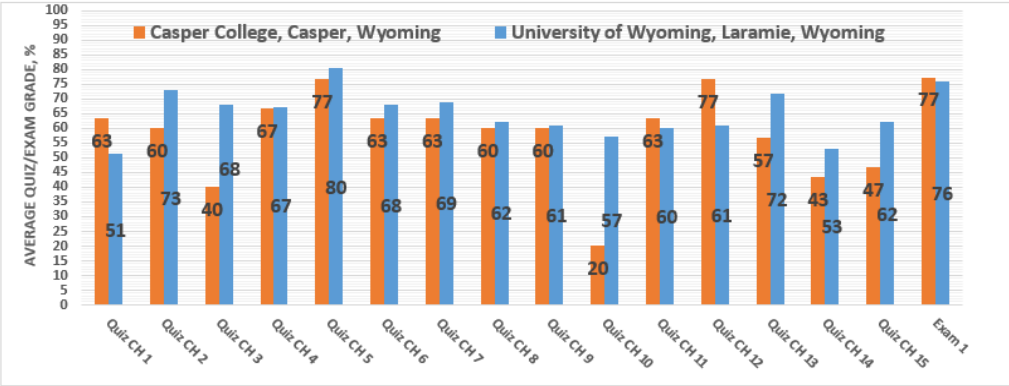

Figure 4. Average Grade Distribution for Quizzes and Exam

Casper College students obtained an average grade of 58.5 percentage points on all 15 quizzes and comprehensive exam, whereas students from the University of Wyoming achieved a slightly higher average of 65 percentage points. In general, the average percentage grades of university students surpassed those of community college students. However, the comprehensive exam exhibited a distinctive trend, with Casper College students obtaining a grade one percentage point higher than their University of Wyoming counterparts. This observed pattern may be attributed to the possibility that university students possessed prior knowledge of the covered concepts from earlier courses in their educational trajectories.

To ascertain the statistical significance of these observations, a Welch Two Sample t-test was conducted using the grades obtained from both university and community college campuses. The analysis revealed that there is no statistically significant difference (p-value = 0.146) between the average grades obtained at the 0.05 significance level. This suggests that, despite the observed variations in average grades between the two institutions, the differences are not significant enough to reject the null hypothesis of no difference in mean grades between the university and community college students.

Table 1
Welch Two Sample t-test

df	p-value	t	95% confidence interval		Decision
22.978	0.146	-1.5046	-15.239299	2.405962	Reject null hypothesis (there is significant difference in mean grades from university and community college)

Analysis of Surveys:

The conducted survey has yielded insightful findings that contribute significantly to the understanding of the co-teaching initiative. The research, which encompasses diverse perspectives from students enrolled in the construction materials and methods course at both the university and community college levels, aimed to gather insights into students' engagement levels, satisfaction with the course, and perceptions of the co-teaching approach. Additionally, faculty members were invited to share their experiences in collaborative teaching, elucidate the challenges they faced, and provide an assessment of the overall effectiveness of the initiative.

The respondents overwhelmingly acknowledged the effectiveness of the co-teaching platform, as evidenced by all survey questions receiving a rating of more than 60%, thereby indicating a notably higher rating overall. The results compiled for the students, as illustrated in Figure 5, revealed that 35 students from the University of Wyoming completed the survey, and an additional five students from Casper College responded to the survey question categories 1, 2, 3 to 13.

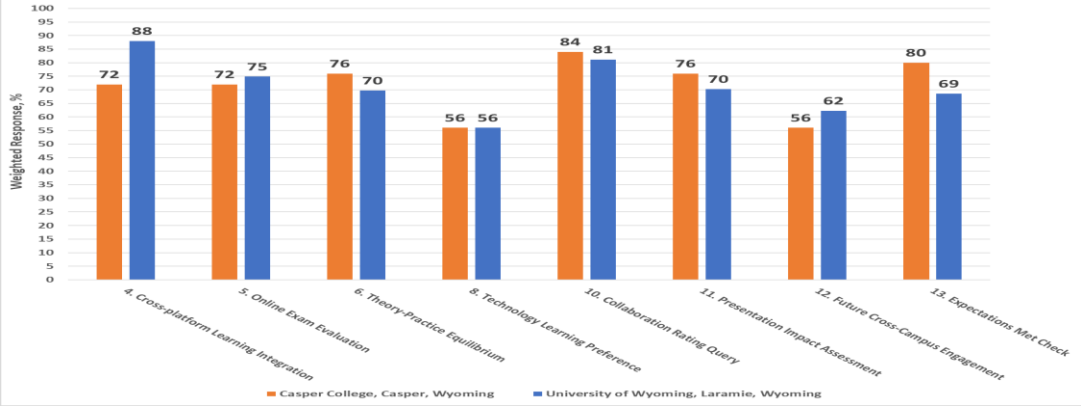

Figure 5. Average Response Rate for Surveys Administered to Students

Furthermore, responses obtained from the survey conducted among all instructors participating in the co-teaching initiative aimed to corroborate the endorsement of the study platform. Figure 6 illustrates a positive trend across all survey questions, such as Question 13. This question aimed to ascertain whether instructors of record perceived that their expectations for students were adequately met, particularly when juxtaposed with the period when the course was exclusively conducted on campus.

In summary, the survey findings depict a developing landscape within the co-teaching platform for construction materials and methods.

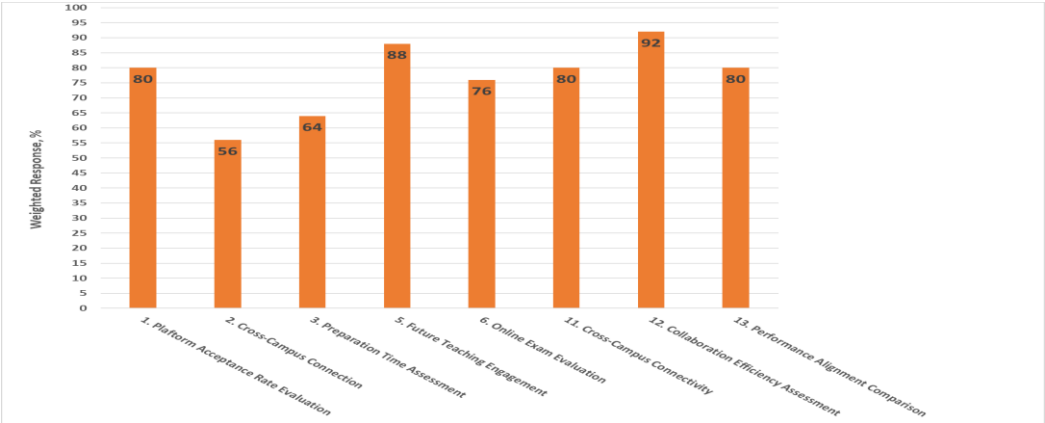

Figure 6. Average Response Rate for Surveys Administered to Instructors

Conclusion

This paper presents a collaborative co-teaching model between a university and community colleges, aimed at enriching articulation between a university's four-year Construction Management program and a community college's two-year associate degree program. Through co-teaching, the study leverages the strengths of both institutions to provide students with a holistic education.

Research findings show optimism about integrating co-teaching into the educational framework, especially regarding curriculum design, exam structure, and collaborative efforts among instructors. While Zoom meetings and Meeting Owl Pro technology are acknowledged, the focus is on their broader impact on teaching alignment and student learning outcomes. The co-teaching platform creates a dynamic, interactive teaching environment that transcends traditional classrooms, enabling real-time engagement and collaboration.

Meeting Owl Pro technology enhances the educational experience by creating a seamless virtual classroom with features like 360-degree video and automatic speaker focus. Surveys with instructors involved in co-teaching confirm the effectiveness of these technological interventions. Positive feedback from exams indicates improved academic performance correlated with the use of these tools.

Overall, the analysis emphasizes the transformative impact of the co-teaching platform, Zoom meetings, and Meeting Owl Pro technology on education, highlighting their role in teaching alignment, enhanced learning outcomes, and reshaping pedagogy in remote education.

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