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A Construction Workforce Training Partnership Between the State of Wyoming, Industry, and University during COVID-19

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Cover Page Footnote

The authors would like to express their appreciation to the Wyoming Department of Workforce Services (WDS) for their generous support of funding the training, as well as the various construction trade associations across the state.

A Construction Workforce Training Partnership Between the State of Wyoming, Industry, and University during COVID-19

Objective: To illustrate the development and implementation of a statewide construction workforce training program between the state, industry, and university during the COVID-19 pandemic. **Background:** Over the last 20 years, there has been a statewide construction workforce shortage, which not only creates an imbalance on the demands in this sector but impairs the profitability of Wyoming-based construction companies. **Method:** The team developed and implemented an online training platform, consisting of five modules, in support of training for construction companies and their workers across the state. **Results:** 149 successful learners received certificates of completion for the online training modules. The success of the training demonstrated that an online training platform like *Zoom* can be utilized to successfully train industry workers. **Conclusion:** The benefit of the training is to increase construction workforce competency of workers across the state in the attempt to also reduce high out-of-state hiring cost. **Application:** The success of the Fall 2020 training promoted the need for similar training in the spring of 2021 to ensure the expansion of a capable construction workforce across the state.

Key Words: Construction Workforce Training, *Zoom* Technology, Construction Education, Teaching Modules, Partnerships.

Introduction

The construction sector plays a fundamental role in the State of Wyoming's economic wellbeing; however, current construction workforce training in Wyoming is limited, which causes construction skill attainment to lag behind that of adjacent states and impair the profitability of construction companies across the state.

The Research and Planning Office of the Wyoming Department of Workforce Services has reported that from the first quarter of 2018 to the first quarter of 2019, Wyoming employment rose by 5,679 jobs (2.2%) and that the total payroll increased by $192,1 million (6.2%). Half of these job gains during the first quarter occurred in the construction sector, which added 2,867 jobs to the workforce (WYOTODAY, 2019). This statistic indicates that job growth in Wyoming has largely been driven by the construction sector. According to Wyoming's long-term job growth projections between 2016 and 2026 (Figure 1), the construction sector in Wyoming is classified as the third fastest growing employment sector, surpassed only by the sectors of mining, oil, and gas, health care and social assistance (Moore, 2020).

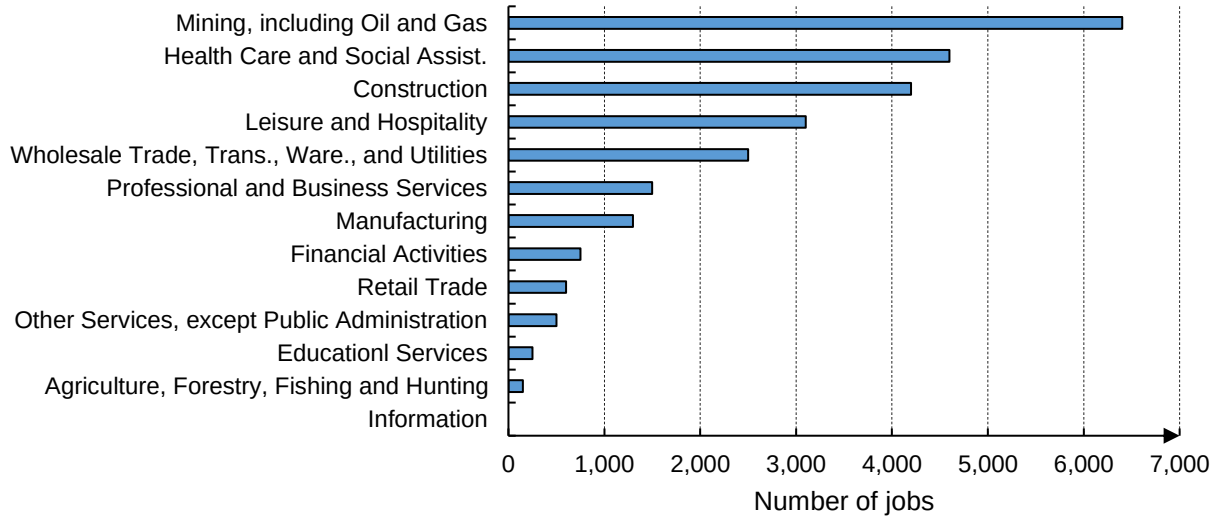

Figure 1. Wyoming's long-term job growth projections between 2016 and 2026 by sector.

Job growth in the construction sector in Wyoming between 2018 and 2020 largely contributed to the increase in construction of oil and gas pipelines. However, in 2021, construction in the energy sector has slowed down since all the gas and oil pipeline projects have reached a near completion state (Moore, 2020). In fact, future energy slowdown is expected in the Biden administration in its fight against climate change in replacing fossil energies by clean energy (Erickson, 2020). Despite the anticipated energy sector slowdown, other construction subsectors like residential buildings, utility systems, highways, and bridges, as well as building of foundations and equipment will expand at a fast pace (Moore, 2020). Unlike professional and business services, manufacturing and other industries, Wyoming's construction sector was not adversely affected by the COVID-19 pandemic as a 1.7% increase in employability was observed between 2019 and 2020 (Moore, 2020).

Even though there is an increase in employability in Wyoming, there was a decrease of specialized labor in construction even before the spread of the COVID-19 pandemic. Figure 2 illustrates the percentage distribution of resident and non-resident workers employed in the constructor sector in Wyoming between 1992 and 2018. It can be observed that, until 1997, the percentage of non-residents employed in the construction sector was only as high as 13% based on total employment. However, after 1997, the disparity increased.

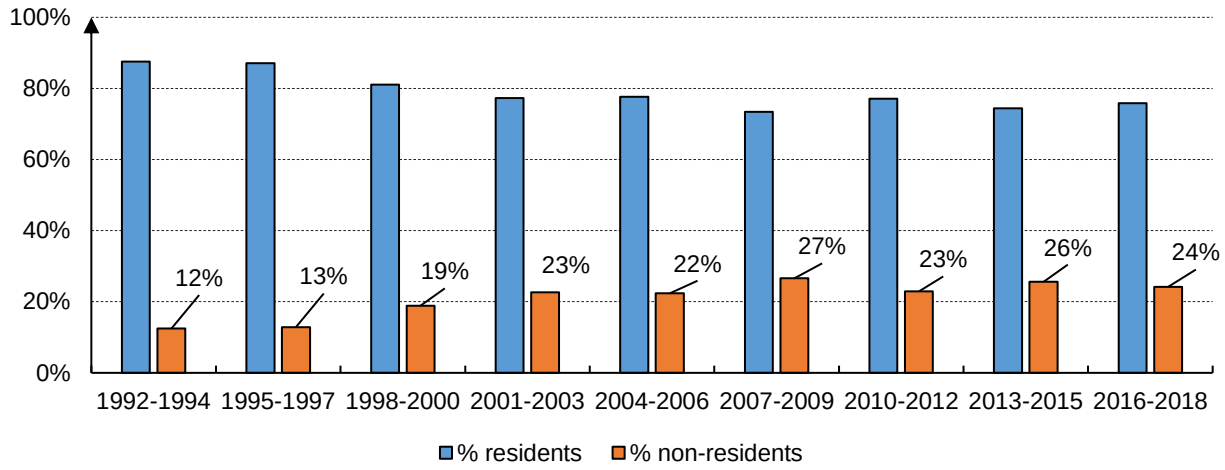

Figure 2. Percentage distribution of residents and non-residents workers employed in the constructor sector in Wyoming between 1992 and 2018.

This trend (increase of non-resident workers in the construction sector) is a potential indication of a lack of interest in and qualification of construction workers as observed over the last 20 years, despite the industry's production stability (Wyoming Department of Workforce Services, 2018). More attractive wages in the sector of mining and gas, and high safety accidents in construction are factors that divert workers away from construction.

A consequence in support of the above rationale is that Wyoming construction companies had to increase the wage in order to attract more workers from Wyoming. The average yearly wage increased 21% between 2010 and 2018, which is significantly higher than the general statewide average yearly wage increases of 9% during the same period (Wyoming Department of Workforce Services, 2018). This substantial wage increase might have been used as a strategy by Wyoming construction companies to encourage more participation of in-state workers in this sector, as the Wyoming legislature restricts the number of out-of-state contractors eligible to bid on Wyoming projects (Bryan, 2014).

Despite the wage increase, it is still difficult to recruit in-state construction workers. When construction companies in Wyoming have to use out-of-state workers to fill the labor shortage gap, companies and contractors are subjected to significant profit challenges. Moreover, although the alternative of hiring out-of-state can temporarily steady the balance between supply and demand, these workers tend to migrate back home after the completion of their respective projects; making this solution unsustainable and always reliant on neighboring states (Fenner et al., 2018). In response to the lack of a trained and capable construction workforce, a solution for this problem would be to provide more education and relevant training to the existing and future construction workforce in Wyoming.

The Wyoming Legislature decided to act by implementing solutions to train and ensure a stable future for the construction workforce. In 2019, the State of Wyoming and the University of Wyoming (UW) committed to developing a 4-year Bachelor of Science in Construction Management degree program in the College of Civil and Architectural Engineering department (CCAE). This program reinforces the two existing technical construction community college

training programs in the state. To ensure the quality of education students in the construction management program receive, the program participates in the American Council for Construction Education (ACCE) accreditation process. It will be the first accredited construction degree program in the State of Wyoming. The program anticipates graduating its first class in the Spring of 2022, at which time the graduates will be able to enter the construction sector in Wyoming with the required industry knowledge and skills. In addition to this degree, the CCAE created an achievement program for the thousands of Wyoming construction workers who are currently employed in the sector but who are not able to commit to a traditional construction training environment. By covering both facets of meeting the industry need, the development and implementation of these training programs is one solution for helping to increase the employability of Wyoming's present and future construction professionals.

The objective of this paper is to focus on the details of what took place in the development and implementation of a construction workforce training program; describing the training modules geared towards already-employed construction workers in Wyoming during the COVID-19 pandemic. The study will highlight the different program partners (state, industry associations, and university) and their respective involvement in the training, delivery method, time commitment, and innovative approaches adopted to overcome challenges imposed by COVID-19, as well as training feedback received from learners.

Literature Review

The construction sector plays a fundamental role in the global economy. In the United States, the construction sector is responsible for 5% of the Gross Domestic Product (GDP) and employs over 5.5 million workers (Sewalk & Nietfeld, 2013). In this sector, labor productivity is an essential factor that characterizes the performance and profitability of the companies (Fenner et al., 2018). It is estimated that labor costs represent as much as 30-50% of the actual costs of construction projects (Karimi et al., 2017). As a result, it is important to develop strategies to maximize the productivity of construction workers.

As a solution to increase long-term productivity, an effective way to motivate workers and enhance their qualifications, is to provide training (Al-Emadi & Marquardt, 2007). Content related to educational requirements to carry out a new task as well as technological requirements in using new equipment are generally offered in these trainings (Fenner et al., 2018). This is especially important for workers with fewer qualifications as this training improves their skills and competencies in order to match the demands of this industry (Watson, 2007). Additionally, training assists young graduates in becoming more familiar with application of the concepts learned in schools (Fayek et al., 2006). For the existing laborers, training is not only provided to prepare them for new projects but is implemented to expand knowledge that may be necessary in the future (Mawer & Jackson, 2005).

Besides improving technical competencies, workforce training can also develop workers' generic skills, such as communication, leadership, teamwork, and multi-tasking, which stimulate an environment of integration and unity among all workers within the company (Daniel et al., 2020). The balance between the enhancement of the technical and generic skills is what leads

workers to produce more for their employers (Detsimas et al., 2016). With the training received, workers become more confident and motivated in conducting their tasks, more committed to the organization, and less likely to abandon the company (Ahmad & Bakar, 2003).

An additional benefit of implementing an effective workforce training program is to reduce work related accidents through education and awareness. As stated by Lingard (2013), workforce training minimizes risks in work sites. Estimates reveal more than 60,000 fatal injuries occur every year in construction projects around the globe. In most of these accidents, the companies that the individuals work for are generally responsible. Apart from the monetary compensations paid to the families and litigation costs, the reputation of these companies is also tarnished in the construction market (Ikpe et al., 2012). The lack of training for workers to understand the importance of following safety protocols is the main cause of accidents (Lin et al., 2018).

Different types of workforce training have been reported in the literature. Theoretical knowledge, where classroom lectures are delivered, is one of the most common training platforms. Classroom lectures are regarded as adequate in teaching basic or high-skill concepts (Clarke & Winch, 2004). However, many researchers think that, dissimilar to practical training, this platform is inefficient for adult workers. Studies suggested that, unlike university students, aged 18 to 24, who are more adapted to pedagogical principles of learning, older students or seasoned workers are more adapted to acquiring information from experiences and examples (Bhandari et al., 2019). For instance, in safety training where theoretical concepts are delivered, only 10-15% of training investments translate into desirable results (Cromwell & Kolb, 2004). According to Garlich and Tesinsky (2005), traditional theoretical classroom training problems usually exist because “the content that is taught does not have practical use in the industry.” What they mean by this is that “third party training providers do not have an accurate understanding of the company demands.”

In comparison to traditional theoretical training, workers embrace practical trainings with a more positive attitude. This type of training consists of having trainees carrying out different tasks on-site under the supervision of an instructor (Fayek et al., 2006). In this approach, workers are not only able to learn specialized technical abilities, but also able to acquire other assets appreciated in the industry such as interpersonal and communication skills, personal qualities, and vocational experience (Fenner et al., 2018). For the development of different skills, some companies devise plans where trainees are assigned to complete assignments in distinct projects (Fayek et al., 2003). Nevertheless, drawbacks such as costs associated to hire experienced instructors, long-time periods of training, and excessive paperwork to comply with the legislature, are some of the challenges that make companies reluctant to implement this type of training (Fenner et al., 2018).

One other major component to these challenges is the distancing restrictions imposed by the Centers for Disease Control and Prevention (CDC). Under the COVID-19 pandemic health mandates, theoretical and practical trainings conducted in-person are temporarily suspended. Thus, to keep the labor productivity at its peak, embracing other training platforms is crucial. One such platform is teleconferencing, a method that enables two or more parties to communicate through live and simultaneous audio and video feeds based on dedicated systems

such as desktops or personal computers (Park et al. 2014). Before the outbreak of the pandemic, teleconferencing had been mostly used to streamline business affairs so that costs and time associated with travel are reduced (Denstadli et al. 2012). Although this means of communication has long been used in the business world as companies started expanding globally, its possible potential in other fields was more fully realized as a means of teaching, learning, and communicating when schools, universities, and other services were required to close.

One example of effective teleconferencing can be observed in the medical field. It is referred to as "Telemedicine," where a physician in one location uses telecommunication to deliver care to a patient at a distant site. This approach works well for a preliminary analysis before the patient visits the doctor or hospital (Zhang et al. 2020). Another example of this innovative approach is the teleconferencing used to conduct training program classes taught by industry practitioners. Teleconferencing programs such as *Meeting OWL* and *Zoom* were adopted in tandem with different setups, depending upon the classroom. Feedback showed that students not only liked the technological component but also felt the importance of inviting professional practitioners to share their expertise, since they can provide insightful information to bridge the gap between classroom instruction and industry (Jacobs et al., in press). Even the federal government has incorporated teleconferencing to employees who work from home. Telework is not new, but the variety of programs developed over the last 10 years to do this kind of work and to have long-distance conference calls to customers or team members is increasing. Programs like *Skype*, *Zoom*, and - most currently - *TEAMS* are all designed to bring off-site co-workers and colleagues together.

Existing literature demonstrates that the use of teleconferencing is an efficient means in carrying out activities in other fields and industries; including K-12 education (Kaden 2020), health care and pharmacy (Tringale and Subica 2020), psychology (Wells et al., in press), social services (Kedia et al. 2021), engineering (Bhute et al. 2021), and others. However, no reference was found in which teleconferencing was used to deliver workforce training in the field of construction.

Methodology and Procedure

The objective of this study is to illustrate the design and implementation of a statewide construction workforce training program partnership between state, industry, and university during the COVID-19 pandemic. The design framework of the construction workforce training program is illustrated in Figure 3. The different entities involved in this training were the State (Wyoming Department of Workforce Services [WDS]), Industry (Trade Associations), and University, which was responsible for the design, implementation, and teaching of the training.

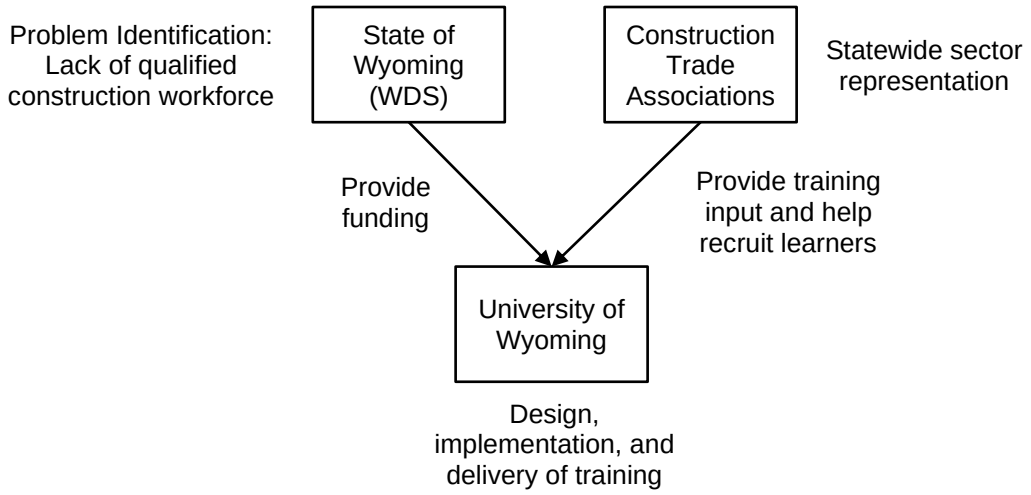

Figure 3. Design framework of the construction workforce training program.

State (Department of Workforce Service)

The construction sector in the State of Wyoming plays a fundamental role in the economic wellbeing of the state at large. Despite its contribution, the state offers limited training towards a growing construction workforce. Even before the pandemic, Wyoming construction companies were forced to recruit workers from neighboring states at a higher cost. In response to this challenge, the WDS has committed funding for the design, implementation, and offering of construction training across all construction related sectors in Wyoming.

Construction Trade Associations

The development of the construction training program and associated training modules were directed with input from various construction trade associations across the state, with specific reference to the General Contractors Association (AGC) of Wyoming, the Wyoming Association of Municipalities (WAM), the Wyoming Department of Transportation (WYDOT), the Wyoming Business Council, the Southeast Wyoming Builders Association (SEWBA), the Wyoming Construction Coalition (WCC), and the Wyoming at Work Association. Due to their close interaction with industry members (companies), the associations provided insightful information on topics to be taught to construction companies and their workers. The associations also provided direct support in the advertisement of the training and lobbying for funding.

University

The construction management program in the College of Civil and Architectural Engineering at UW applied for workforce training funding from the state. The funding allowed faculty in the program to develop five training modules as derived from the construction management program curriculum framework (Figure 4). Each one of the five modules was derived from a 16-week semester long construction management class. This condensed teaching and learning experience was adopted based on input provided by the trade associations on the need for specific training.

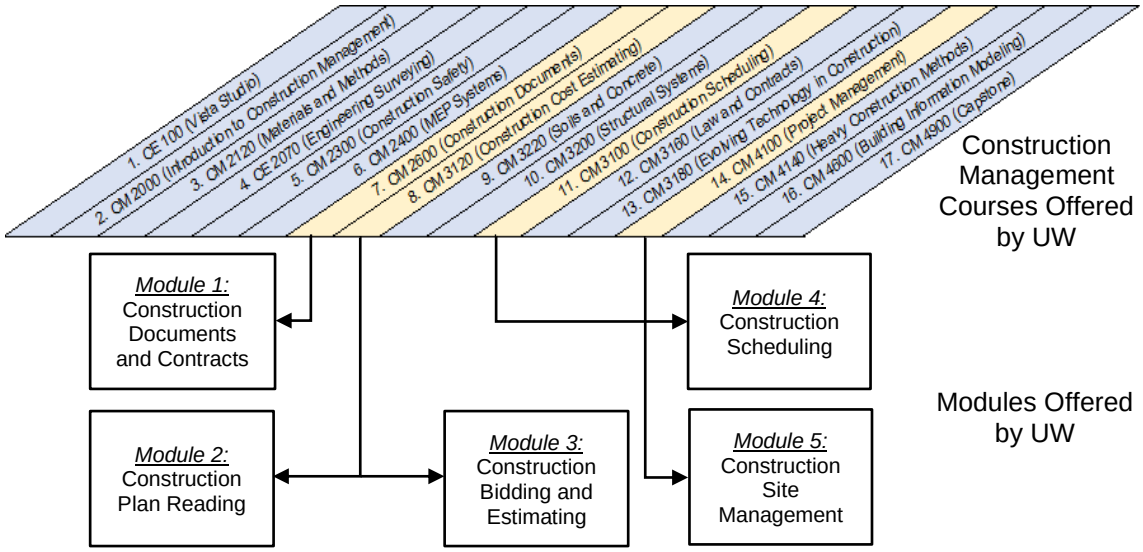

Figure 4. Module alignment based of the construction management curriculum.

The five training modules were designed at the introduction level in order to accommodate learning without any prior knowledge. Instructors contoured the modules around the following five topical content areas:

Module 1 – Construction Documents and Contracts;
Module 2 – Construction Plan Reading;
Module 3 – Construction Bidding and Estimating;
Module 4 – Construction Scheduling; and
Module 5 – Construction Site Management.

Module Composition and Delivery

Each module required an 8-hour time commitment from learners to successfully process through the content. The 8-hour commitment was divided into two 4-hour instruction sessions over a two-week period in order to best accommodate the working schedule of practitioners, during the hours of 1 to 5 p.m. Construction management faculty taught all five modules as a non-subcontracted agreement in offering learners the ability to obtain similar knowledge as students in the construction management program. Although trade associations did not request the inclusion of construction safety training, the importance of construction safety came up several times during the modules as a company's responsibility to train workers on safety measures.

A professional construction workforce training marketing flyer was designed with an imbedded hyperlink that directed learners to a UW construction training workforce website for the registration of the modules. *Canvas* was used as the preferred Learning Management System (MLS). Once registered for a module, learners are able to download module content (PowerPoint slides, blueprints, case studies, and group projects). The College of Civil and Architectural Engineering issued a Certificate of Completion for each module completed and a Certificate of Accomplishment if all five modules were completed.

To comply with the CDC's COVID-19 social distancing requirements, the UW workforce training program committed to the teleconference format. All modules were broadcast via *Zoom* from the UW campus in Laramie, Wyoming. Teaching was delivered synchronously, which allowed instructors to engage with the learners in real-time, as if meeting face-to-face in a classroom setting. Lectures, consisting of conceptual content, were delivered during the first hour of each *Zoom* session. In support of a better learning experience, practice examples were solved online by instructors for participants to follow along.

Additionally, the *Zoom* platform further allowed participants to engage in breakout room session to work on group projects. Moreover, real-time on-site interviews with professional practitioners (Figure 5a) were also incorporated as part of the training experience, in which course-related topics, including occupational safety, equipment storage, quality control, and scheduling were discussed. To support this onsite learning modality, an I-Pad was used during the instruction of project scheduling and jobsite layout (Figure 5b). These innovative learning approaches were viewed as solutions in overcoming the barrier of face-to-face instruction during COVID limitations.

Figure 5.a)
Using an I-Pad so that students can participate in an onsite interview with an industry practitioner on course-related topics.

Figure 5.b)
Using an I-Pad so that students can watch the industry practitioner as he explains his project scheduling board.

Findings and Discussion

Learners were asked to participate in a Qualtrics exit survey to share their perceived learning experience upon the completion of each module inn which they participated. The survey data was analyzed in support of the following enrollment and participation findings. A total of 149 Certificates of Completion and 21 Certificates of Accomplishment were issued to those students who successfully completed the requirements.

Enrollment and Participation

The distribution of enrollment across the five modules are displayed in Figure 6. An average of 35 learners enrolled per module. Module 1 (Construction Documents and Contracts) demonstrated the highest number of learners (38) eligible for a Certificate of Completion and the

highest completion rate (88%). In order to successfully complete a module, learners had to participate in both 4-hour instruction sessions. Module 2 (Construction Plan Reading) had the highest enrollment (45) but the lowest completion rate (78%). Although Modules 3, 4, and 5 had relatively low enrollment numbers, their completion rates were above 85%

The specific topical content that was covered in each module might explain the enrollment disparity across the modules. Another factor that might explain enrollment disparity across the modules is that not all workers were given the opportunity to attend both *Zoom* sessions by their employers between 1:00 and 5:00 p.m. during the week.

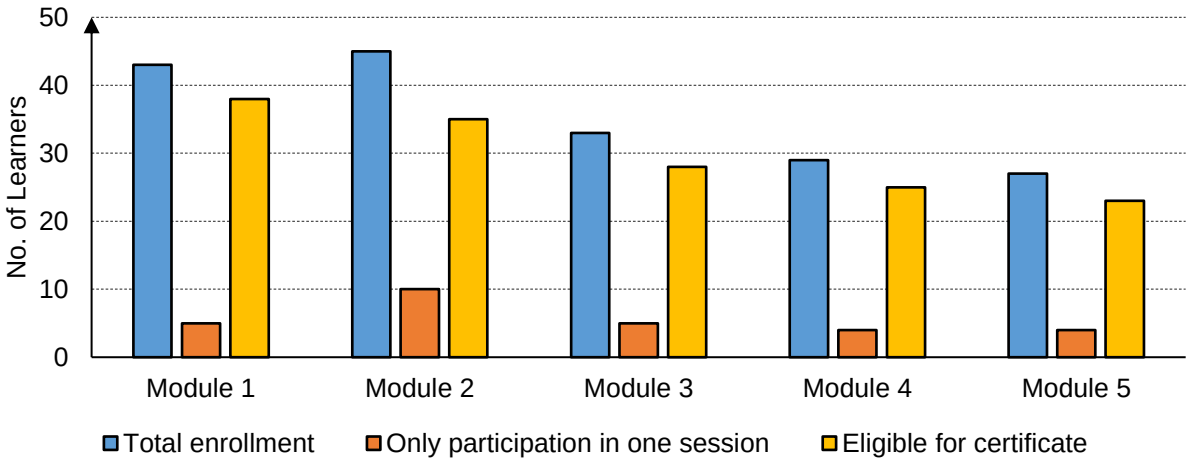

Figure 6. Distribution of enrollment by module.

Figure 7 illustrates the engagement of learners per county across the state. The distribution is relatively widespread except for the northwest counties with fewer construction activities. On the other hand, cities with greater population and more contribution to the economy (Cheyenne, Casper, and Laramie) revealed greater participation interest compared to the remaining localities.

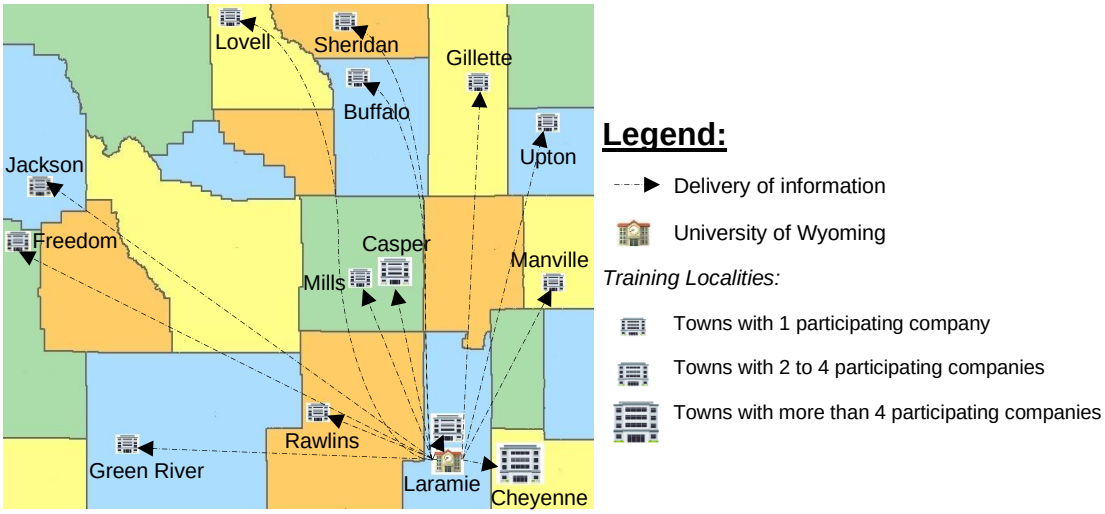

Figure 7. Engagement of learners per county.

The success of training engagement across the state was largely imbedded in the efforts put forth through various marketing initiatives. Figure 8 displays the distribution of marketing venues used to inform companies and learners about the training. The majority of learners (56%) were informed about the training through their companies and trade associations. Several companies incentivized their workers to participate during weekly work hours as paid time. Also, the figure shows that the professional workforce training website (16%) designed by the university in tandem with a training flyer (8%) also helped with the recruitment of learners. Finally, 20% of the learners were informed about the training by word-of -mouth advertising from their colleagues or friends.

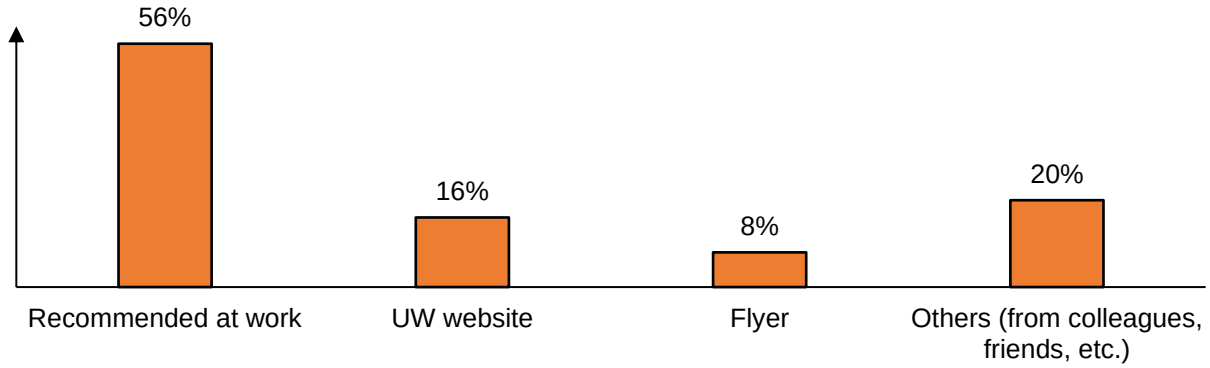

Figure 8. Different sources from which learners were informed about the training.

Learner Feedback

The survey data revealed that 88% of the learners had a positive experience using *Zoom* and considered it to be a good alternative learning platform compared to that of face-to-face instruction. Nevertheless, the remaining 12% of the learners did express their unfamiliarity with *Zoom* as not user friendly based on their struggle to access shared content within the software platform. This feedback prompted the development of an online video tutorial on the different *Zoom* functionalities for future training. Also 88% of the learners liked the breakout room feature provided by the platform, since learners could work in group settings. The intent of having breakout room activities is to stimulate communication and discussion between the group members and have them engaged in activities, as if the class were delivered in-person. However, 12% of the learners did express frustration as some group members did not have access to a camera or microphone, which made communication difficult. This feedback prompted a mandatory requirement for all future learners to have access to a camera and microphone.

Feedback on the preferred learning method and time commitment per module in support of future training, were divided between the current format (online interaction only) and a hybrid format (online plus face-to-face interaction). Although it is understandable that the learners would feel more integrated in the class if the modules were done in-person, for the safety of the community, this learning method is currently not possible. However, once the COVID-19 vaccine is available to the general public, this option could be considered. In terms of preferred time commitment for future training, 80% of the learners approved the current format where each module is split into two sessions of 4 hours, while only 20% of the learners would rather

have a full-day of training. The conclusion is expected since it is difficult for the learners (and the instructors) to concentrate and work efficiently for 8-hours straight.

Figure 9 depicts suggestions provided by learners to help improve future trainings. Some learners (20%) indicated their support for increased breakout sessions where they can work and learn in group settings. Others (32%) indicated their support for analyzing more case studies. This conclusion is expected, especially from learners who work in WYDOT, as their daily work involves heavy structures including roads and bridges while the content of the modules focused only on buildings. Furthermore, 4% of the learners would like to have more interactive discussions like the interview with the professional practitioners. Finally, 44% of the learners proposed other recommendations which include the assignment of individual graded homework, more handouts, and more *Zoom* chat box interaction.

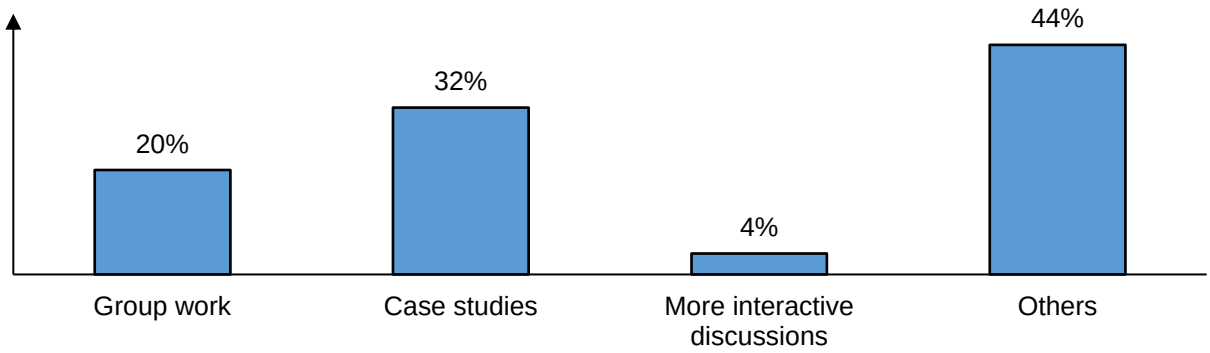

Figure 9. Suggestions provided by learners to improve future training.

General feedback on the instructors was unanimously positive with strong support on the organizational structure of the modules. Constructive quotes included some of the following:

- “I personally feel that the instructor of record is doing a wonderful detailed educational course with our allotted time and the number of attendees online. Great classes offered.”

- “The instructor of record did a great job with instructing. He has a very vast knowledge and experience in the construction field. I highly respect him as an instructor. [He stimulates] great interaction and asks for comments and/or responses. Wonderful job!”

- “These courses are structured great. Thank you!”

- “The group work in breakout sessions has been very helpful!”

Conclusions and Future Research

The stability of the construction sector in support of added jobs between 2018 and 2020 in Wyoming have demonstrated that this sector plays a fundamental role in the state economic wellbeing. Despite this significant contribution, construction workforce training across the state is limited which causes construction skill attainment to lag behind that of adjacent states.

This need of training in support of a capable workforce has obligated the state to commit to the development of a 4-year Bachelor of Science in Construction Management program at UW. In tandem, the university has also joined forces with the WDS and different trade associations across the state to develop a construction workforce training program for construction companies and their workers.

This training program consists of five modules that were selected from construction management courses offered in the CM degree program at the university. Each module was delivered in two 4-hour sessions over a two-week period by UW construction management faculty. The training sessions were conducted via *Zoom* in order to comply with the CDC's COVID-19 mandates. Instructors incorporated different pedagogical approaches in order to best mimic the experience of face-to-face instruction. Besides the theoretical component, practical examples, group projects, and real-time interviews with professional practitioners were also incorporated as part of the learning experience utilizing the features provided by *Zoom*. Learners were issued a Certificate of Completion upon the completion of each training module and a Certificate of Accomplishment upon the successful completion of all five modules. A total of 149 Certificates of Completion and 21 Certificates of Accomplishment were issued.

An average of 35 learners enrolled per module and the completion rate varied between 78% and 88% across all modules. Survey data retrieved from learners demonstrated that the varied completion rates was mainly due to the inability to fully commit to training during weekly working hours. Survey data further revealed that there was substantially more participation from localities with greater population like Cheyenne, Casper, and Laramie across the state. Also, the majority (56%) of learners were made aware of the training through their companies and trade associations.

Survey data further revealed that 88% of learners reported a good experience using *Zoom* as they consider it to be a good alternative to face-to-face instruction. A *Zoom* activity that the learners highly valued was the group project through the breakout room session feature, which allowed them to engage in discussions about course-related topics as a group. Many learners suggested the inclusion of additional case studies with an emphasis on heavy structures such as roads and bridges. Some learners recommended the option of individual homework as part of a requirement to successfully complete a module. As an overall perspective, it was concluded that the training was successfully delivered even with the challenges caused by the COVID-19 pandemic.

Despite the challenges posed by the COVID-19 pandemic, it is expected that construction workforce training delivered via *Zoom* will have a positive impact on the state's construction sector in the following ways:

- Increase the productivity and profitability of the sector by addressing the current construction workforce training shortfall,
- Reduce high out-of-state hiring costs of construction professionals,
- Create a sustainable construction workforce through the training of currently employed construction workers,
- Promote professionalism in areas ancillary to the construction sector, and

- Develop solutions to construction challenges in Wyoming through teaching of evolving technologies.

As it is important to have ongoing training for the construction workers in Wyoming with the intent to overcome the lack of qualifications of the workforce, the success of the Fall 2020 construction workforce training will be repeated during the Spring of 2021. Based on the suggestions provided by the learners, the trade associations and WDS, the five modules scheduled for the Spring of 2021 will be delivered in the following format: each module consists of 4 hours of synchronous *Zoom* instruction, accompanied by 4 hours of assigned (individualized) homework. This adjustment is to provide learners with more flexibility during their workweek to successfully process through the content.

Future research on the topic area will include the development and implementation of a similar teaching platform geared towards high school students across the state. A construction workforce training track for high school students will help create a pipeline of potential students interested in pursuing construction as a career field. The first phase of this initiative (beta testing) has already started with the selection and inclusion of three high school students from different districts that will participate in the Spring 2021 workforce training modules. This beta testing initiative will help in the development and implementation of a statewide construction workforce training program geared exclusively to the high school demographic.

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