

Training Centers of the Future: Exploring the Efficacy of Virtual Reality



Prepared by FMI Corporation
Sponsored by:
International Union of Painters and Allied Trades.
Industrial Training International
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SUMMARY

Exceptional advancements in Virtual Reality (VR) technology have been made in recent years, and there is great interest in the potential applications of it across industries. It is currently forecast that the market for VR globally will surpass \$25 billion (USD) in less than five years and near \$50 billion (USD) within a decade. This represents a Compound Annual Growth Rate (CAGR) of more than 50%. Education and training may represent the greatest beneficiaries of this trend over time, introducing altogether new ways to immerse the student or trainee into a lesson or exercise.

The use of simulation in training is not a new phenomenon. It has been used for more than 100 years. As early as 1917, the military has used simulation to train airplane gunners. Over time, this form of training has been expanded to include astronauts and pilots. However, the cost of these simulators, particularly from a hardware perspective, were prohibitive and therefore limited to a small community of users. Since roughly the turn of the 21st century, technological innovation has significantly reduced the cost of hardware, created an abundance of content and maximized software features, and grown the user pool from the few to the many. What was once out of reach to most may now be acquired for a few thousand dollars.

We believe that VR presents itself as a particularly valuable complement to construction equipment operator training, development and evaluation. Considering the inherent costs and risks associated with live construction equipment operator training, VR has the potential to accelerate the acquisition and retainment of skills, improve safety, and reduce costs (both direct and indirect). Educator/Trainer, space and weather limitations are largely removed with VR. Moreover, remote evaluations are fully possible in a VR environment. VR is not expected to replace nor diminish the importance of live training, but it will elevate the value of the live training that is ultimately required.

The people that participated in this study estimate that operator competency may be achieved in 60% to 70% of the time with the addition of VR compared to traditional methods alone. They also believe VR would lead to better outcomes in operator performance, retention of knowledge and confidence in operator competence. Regarding the latter, VR provides the opportunity to develop an operator competency score, similar to a FICO score, something 85% of survey respondents described as valuable. Last, trainee interest and engagement has shown to be greater with VR, particularly when considering the upcoming generation of workers.

The greatest hindrance to the use of VR is the lack of familiarity that exists in the industry. This can lead to many misconceptions about VR, including cost, availability, limited applications, etc. As such, we recommend anyone interested in VR to contact one of the sponsors of this research to learn more and determine how to improve the training experience and outcomes for your company.

INTRODUCTION

It is believed that Virtual Reality (VR) presents a valuable complement to traditional construction equipment operator training. Our research thesis was *Introducing VR to the training and evaluation of aerial lift and crane operators can significantly reduce costs, accelerate competency, and attract the next generation*. The research presented herein was therefore designed to answer three overarching questions. They are:

1. What are the true costs of training and evaluating aerial lift and crane operators?
2. What are the perceptions of current training and evaluation?
3. What are the perceptions of legacy simulators and immersive VR?

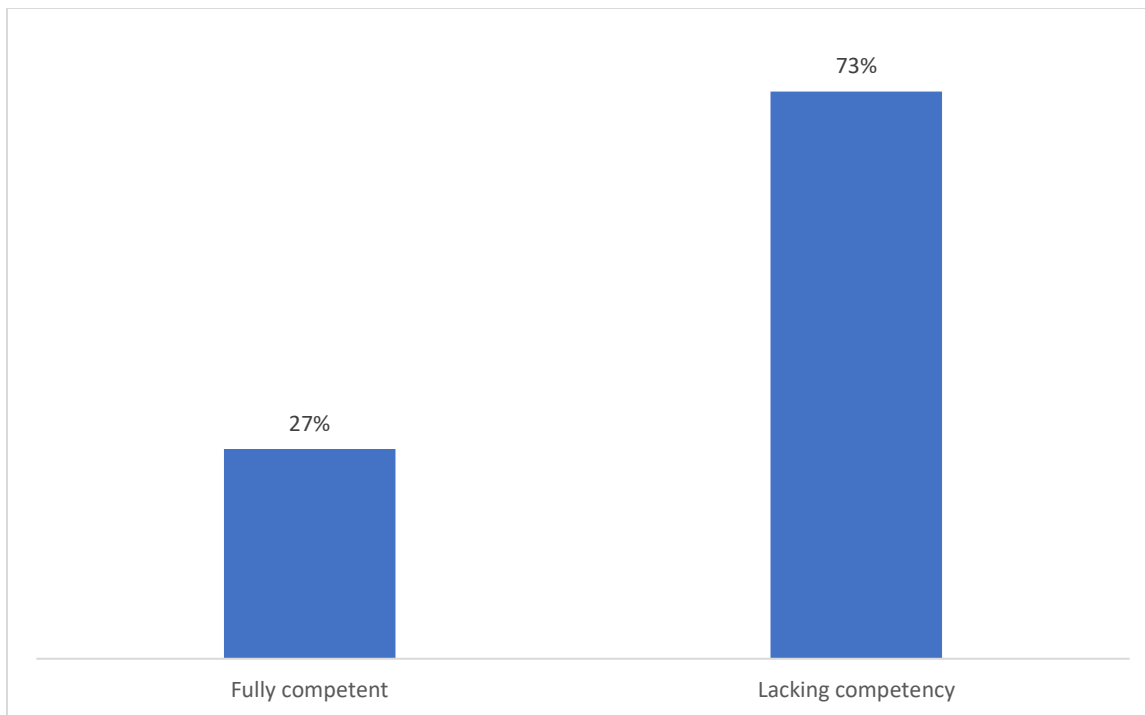
This report on the efficacy of VR as a complement to traditional construction equipment operator training is focused specifically on U.S.-based aerial lift and crane operators and was sponsored by the International Union of Painters and Allied Trades, Industrial Training International, Serious Labs, and United Rentals. The research was conducted by FMI Corporation during the months of January through May 2018. Our findings are based on an extensive public literature scan and direct feedback from industry stakeholders and subject matter experts. Approximately 1,000 contractors that employ crane and aerial lift operators in the U.S. were identified, both those that have used VR-enabled training and those that have not but may be familiar with it. Of these identified contractors, 21 in-depth interviews were conducted and 118 completed an electronic survey questionnaire.

FINDINGS

Finding 1: Current certification/licensure of aerial lift and crane operators does not adequately convey individual skill levels and can result in underqualified hires.

It is perhaps not surprising that the majority of survey respondents (73%) do not believe that certification or licensure of aerial lift and crane operators adequately conveys competence. This is no different than ownership of a driver's license demonstrates a person's ability to expertly operate a motor vehicle. Yet similar to a driver's license, operator certification or licensure represents a base-level requisite with its limitations understood by most. As one interviewee said, "We would not take a license to mean someone knew how to operate a crane," but even if it did, it would still not adequately convey competence of operation.

Exhibit 1: Expectations of operators upon receiving certification/licensure
Percent of survey responses (n=118)
Source: FMI

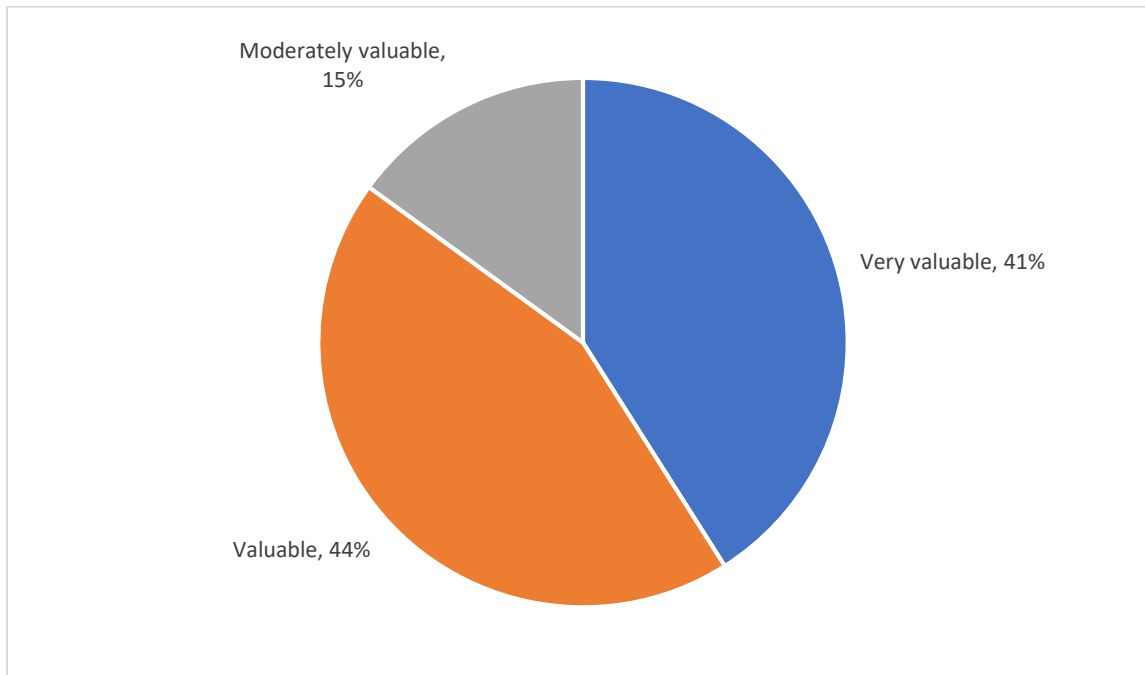


Considering that the construction industry ranks fifth among all U.S. industries in terms of employee turnover rate, which is also higher than the national average of all industries, the ability to accurately determine competency quickly is important. Furthermore, the required skills set for the average person in construction is much greater than those of the top-three industries in terms of employee turnover; accommodation and food services, leisure and hospitality, and retail trade. VR presents a confident means of "verifying" operator competence prior to hiring. The value of this verification, like that of a FICO score, was overwhelmingly agreed to by the vast majority of survey respondents (85%).

Exhibit 2: How valuable would a validated operator competency score — similar to an objective/quantitative exam or FICO score — be to you?

Percent of survey responses (n=118)

Source: FMI



Note: No survey respondent answered, “Slightly valuable” or “Not valuable.”

Finding 2: Numerous training methods are employed by the industry, with no overwhelming “one way” of developing operator skills.

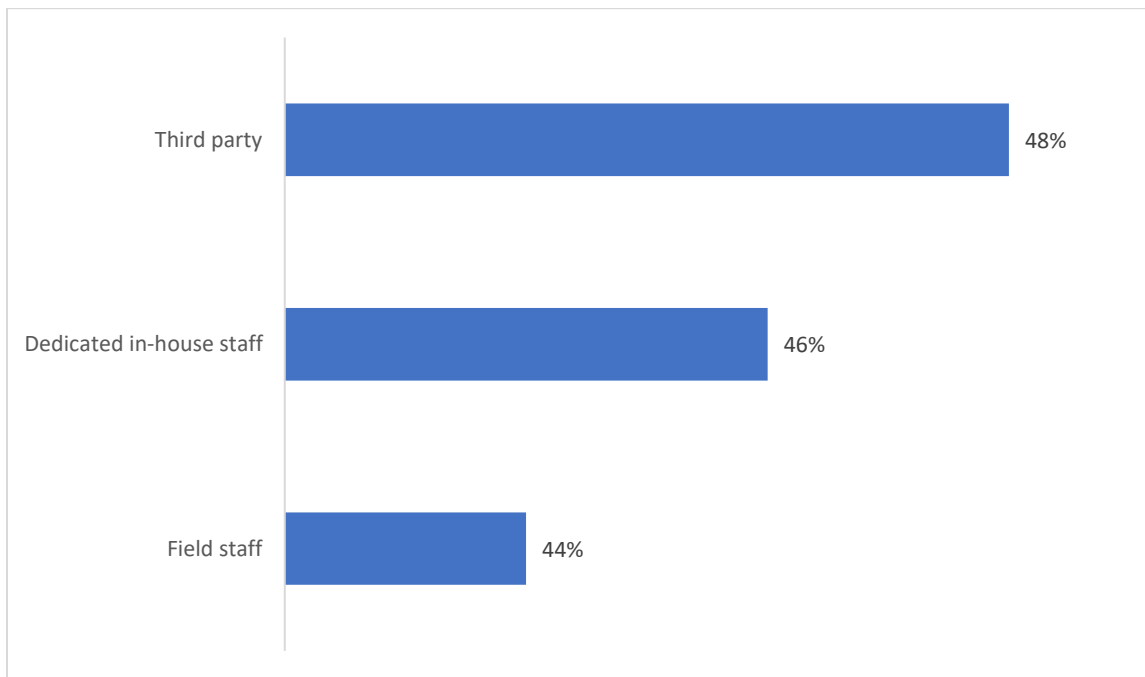
Multiple means of training aerial lift and crane operators are employed across the industry, with most survey respondents employing more than one. These range from dedicated in-house trainers to field supervisors providing on-the-job training to third-party providers. A mix of training methods/sources is probably best, as each presents the opportunity to instruct and evaluate various aspects of equipment operation. This pattern of response is consistent regardless of company size and type of equipment/operator trained.

With such a large number of firms presumably using third-party training sources, incorporating VR should therefore not be overly difficult. More so, VR complements *both* internal and external training. Perhaps the greatest benefit it provides in this regard is the additional “seat time” for operators to practice what they have learned without the need for actual equipment or a present instructor. The frequency of practice this presents, along with standardized, objective testing and the ability to simulate multiple environments, could vastly improve competency assessment.

Exhibit 3: Which of the following do you use to train your operators?

Percent of survey respondents (n=118)

Source: FMI



When one considers refresher courses or simply confirming an operator’s skills set is at an expected level, VR provides an efficient way to achieve both. Approximately half of survey respondents indicated that their aerial lift/mobile elevated work platform operators required refresher courses two more times per year. VR may significantly reduce the time required to demonstrate retained knowledge and proficiency by simply allowing the operator to “prove” it in a simulated situation. Moreover, these VR refresher courses may be customized to test particular competencies that an operator may have struggled with previously.

Finding 3: The cost of aerial lift and crane operator training is significant, but likely not fully apparent.

The estimated costs associated with aerial lift and crane operator training are significant. The research suggests that these costs can be in the tens of thousands of dollars range. This accounts for both direct and indirect costs. The latter in particular may be much greater than most people assume. For example, some of the indirect costs the research revealed include:

- Field staff spend an average of 10% to 15% of their time training equipment operators, which can equate to more than \$10,000 per operator trained given current compensation trends.
- Greater than 50% of operator training occurs on company-owned equipment. In addition to the loss of time that the equipment may have been utilized for project-related activities, damage to equipment during live training exercises average about \$1,500 based on survey results. Half of the survey respondents also reported that damage to equipment during more than one out of 10 live training events.

- Perhaps much more difficult to quantify is the cost of making a poor hiring decision. This not only includes recruitment-related costs but others like relocation costs, lost time, etc. As previously mentioned, certification/licensure does not adequately convey competency. Furthermore, one interviewee revealed that certification/licensure for a crane may be given without the operator having actually been trained on one.

“In the UAE, there is a crane license. But to get it, you get trained on a forklift... now when we hire people, who are licensed, we put them through the simulator, so they can get a feel for how the controls work and how to move the machine the right way.”

– Study participant

VR presents the opportunity to assess an operator’s competency remotely before relocating him or her to the job site. Moreover, the site conditions that the operator is likely to encounter can be presented in the simulator, along with specific required skills, to determine fit.

Finding 4: The market realizes that “a better way” is possible.

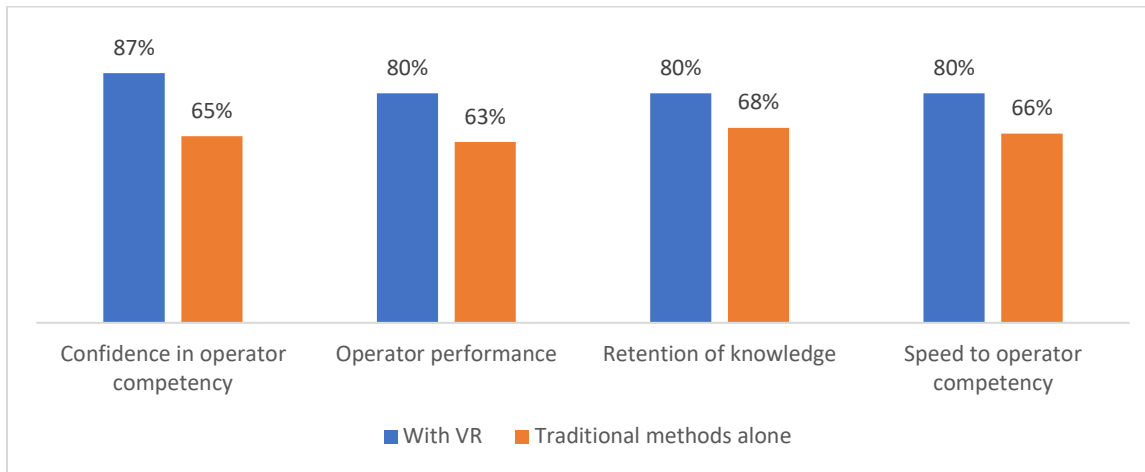
Our research identified three major perceived benefits of incorporating VR into aerial lift and crane operator training. They are 1) more effective training, 2) lower costs and risks, and 3) attracting new operators.

Training more effectively — Simulators provide real-time feedback to operators, trainers and HR staff. This includes the ability to measure things not possible with traditional methods, such as simulating different site conditions and environments and eye movement and focus. As such, the ability to pinpoint areas for development/improvement is greatly enhanced. In addition, it has been demonstrated that self-guided work and scoring increases autonomy and motivation. Research suggests that autonomy is a key contributor to employee engagement and productivity. VR facilitates these. This may explain why most study participants estimated that operator competency could be achieved with the addition of VR in 60% to 70% of the time as traditional methods alone.

Exhibit 4: Percent of survey respondents answering “Very good” or “Good” to perceived training effectiveness of traditional methods including VR and traditional methods alone.

Percent of survey respondents (n=118)

Source: FMI



Lowering cost and risk — Virtual training allows for mistakes without consequences. As previously noted, half of the survey respondents reported damage to equipment in more than one out of 10 training exercises. Construction is dangerous. OSHA reports that one in 10 construction workers are injured every year, and 60% of construction workplace injuries occur within an employee’s first year of employment according to the BLS. Therefore, protecting new operators and others is critical. VR allows for training in a controlled, in-door environment.

From a cost perspective, simulators can save on the purchase and maintenance of real equipment. It also improves utilization of expensive equipment for productive means. Describing the cost of training a crane operator, one study participant said, “*We did set up our own equipment, but that didn’t work well because you have to have a good crane there. It is expensive to set aside something like that just for training.*”

Attracting additional operators — The shortage of skilled labor has become an increasing challenge for the construction industry. Therefore, the ability to recruit and hire those that are available is not only a necessity but a potential competitive advantage. However, previous methods of doing so may no longer align with the expectations and interests of the next generation. This next generation is sometimes referred to as the first “Digital Natives.” Technology has been ever present in their lives. VR aligns with this next generation’s experiences, expectations and preferences. They will then naturally gravitate towards employers that are technologically savvy. Many of the people we interviewed for this study described how VR is accomplishing this and proving a strong attraction for new talent. As one interviewee noted, “*We are taking it to the Future Building Expo. We have our paint simulator at one end and the Serious Labs simulator at the other. [The Expo] has 80,000 students registered over the three days. It definitely seems to be something the younger generation gravitates towards. It helps us draw people in who don’t know much about the construction industry.*”

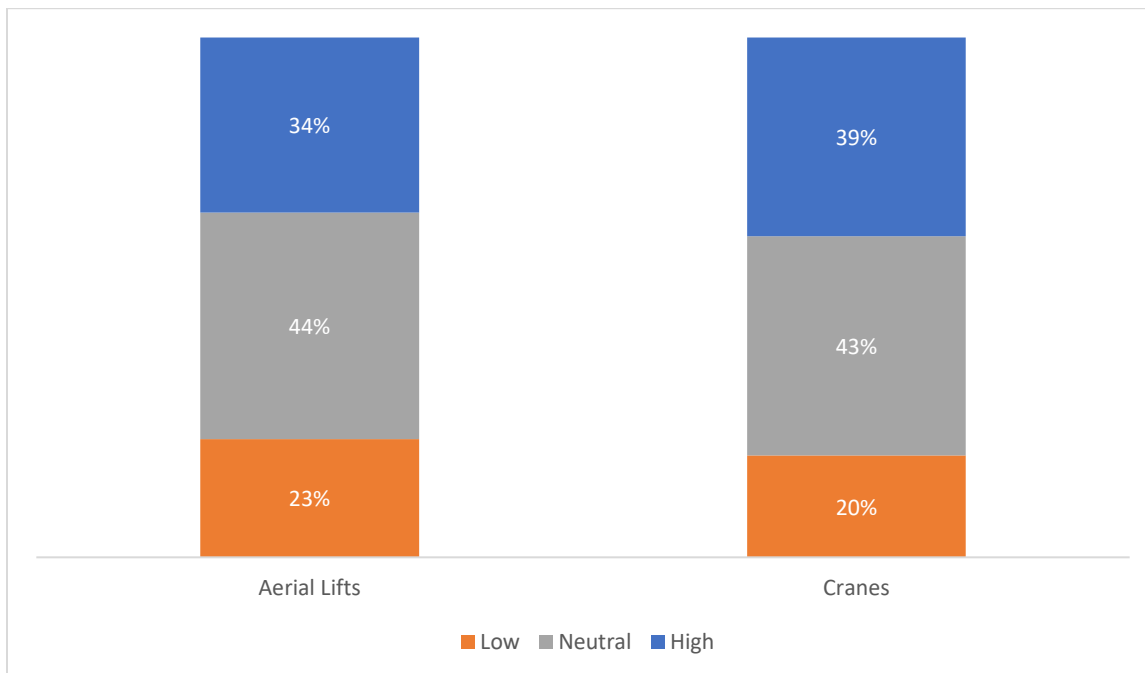
Finding 5: Broad interest in VR as an enhancement to current aerial lift and crane operator training exists.

There is broad interest in VR among the people that participated in our study for many of the reasons already discussed. When asked their likelihood to use VR for training or assessing aerial lift and crane operators if given the opportunity, more than one-third of survey respondents expressed high likelihood compared to less than 25% that would likely not.

Exhibit 5: If given the opportunity to use immersive VR for training or assessing operators, how likely would you be to do so on a scale of 0 (not at all) to 10 (absolutely)?

Percent of survey respondents (n=118)

Source: FMI

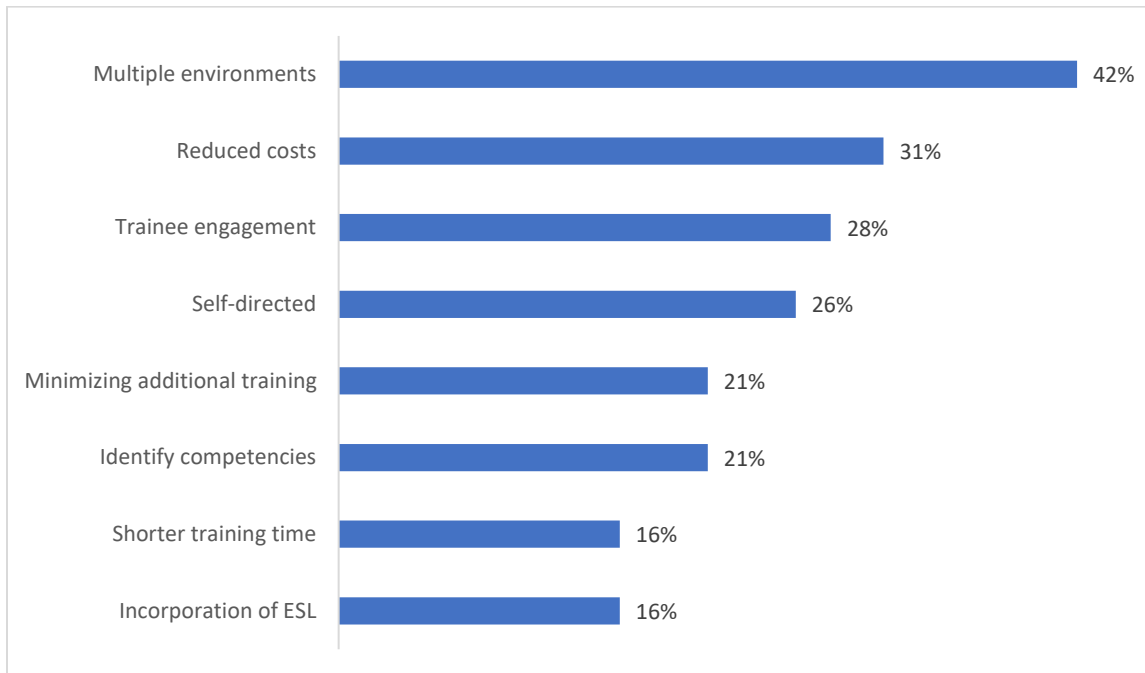


Interest in VR as a complement to traditional training methods for aerial lift and crane operators stems from many of the perceived benefits previously mentioned: more effective training, lower costs and risks, and attracting new operators. When asked to rank order the benefits of VR in this regard, survey respondents that have not previously used VR ranked the effectiveness of training (via the ability to present multiple environments), reduced training costs, and trainee engagement as the three greatest perceived benefits.

Exhibit 6: Rank the following in order of greatest perceived benefit to least perceived benefit of immersive VR-based training of operators compared to traditional training methods.

Percent of first and second place rankings (n=118)

Source: FMI



Finding 6: The greatest hindrance to adoption of VR training is the lack of familiarity and where it “fits” in the training process and the benefits it provides.

So what is preventing broader use of VR in aerial lift and crane operator training? For most, it is simply a lack of familiarity with VR. More than 80% of survey respondents have never seen VR used in this manner, only having heard or read about it. This lack of familiarity has probably created some misconceptions, including the cost of VR training (both hardware and software requirements) and availability of immersive VR training products. Perhaps the greatest hindrance to adoption though is the belief that VR is not suitable for developing operator competency. One person we interviewed agreed but quickly noted the change of opinion within the company after its introduction.

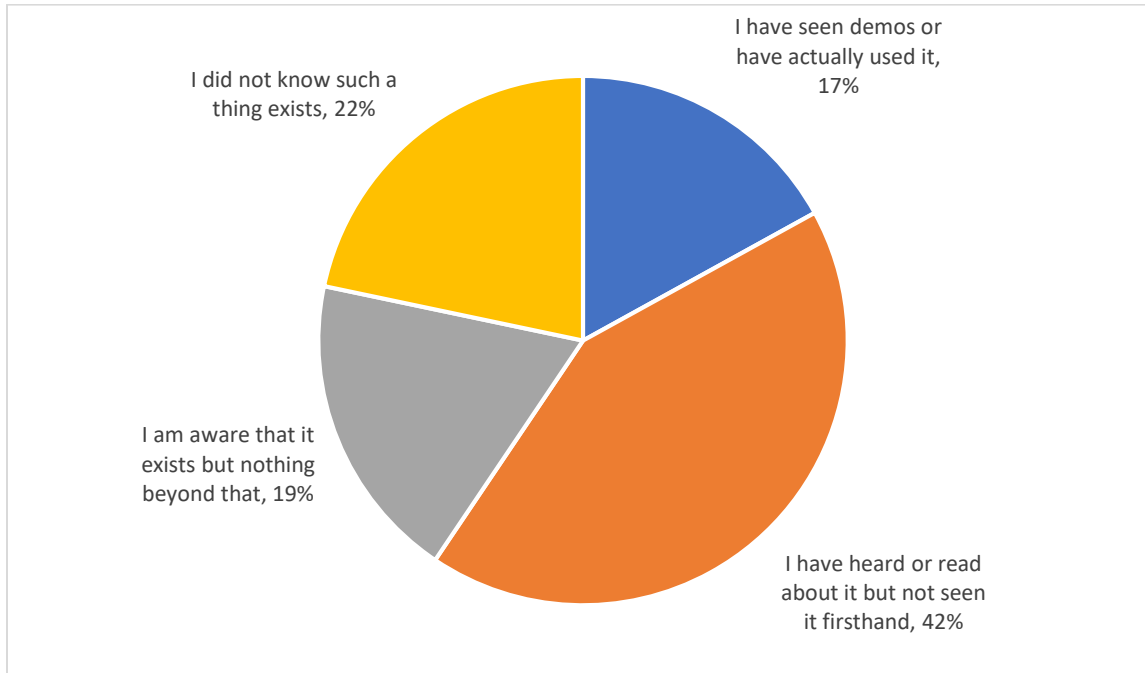
“When we first started using it, there was a huge backlash. Nobody wanted to get in it. We had to force people. Because it was ‘ah, it’s just a toy, it’s just a game.’ But without a doubt, every single person who is a crane operator, who has ever sat in it has said they should have had one of these years ago.”

– Study Participant

Exhibit 6: How familiar are you with immersive VR for training or assessing aerial lift and/or crane operators?

Percent of survey respondents (n=118)

Source: FMI



CONCLUSION

We believe the research clearly demonstrates that the current certification and training of aerial lift and crane operators can be significantly enhanced with the incorporation of VR. Not only does VR offer the potential to reduce training costs, improve safety, increase engagement, accelerate competency and attract new employees, it may represent the expected means of operator training and evaluation in the future. Resistance to new technologies is quickly disappearing in the construction industry with the transition from one generation to the next. Therefore, having a technology strategy is essential, including one for incorporating VR into training. You need to know what technologies will benefit your organization and how. This means there must be value in the technology, including a sense of purpose, goals, employee training and a process designed and implemented for consistent adoption of it.

VR is not just a means to better train operators, it is a way to create excitement and demand for training among operators.

RECOMMENDATIONS

1. Estimate the cost of training your aerial lift and crane operators.

Include all the costs of training. This includes the time spent by internal staff that may be providing training, the cost of the equipment, certification costs, etc. Identify where inefficiencies in training operators may exist in your company. Next consider the possible savings and additional benefits of removing these inefficiencies,

2. Learn more about incorporating VR into your aerial lift and crane operator training.

Visit the ITI, Serious Labs, and United Academy websites.

- ITI (www.iti.com/vr)
- Serious Labs (<https://seriouslabs.com>)
- United Academy (<https://unitedacademy.ur.com>)

Contact any of the following:

- Wade Carson, Sales: Serious Labs wade.carson@seriouslabs.com
- Ken MacLean, President: Serious Labs ken.macleam@seriouslabs.com
- Joe Franz, United Rentals jfranze@ur.com
- Grant Winters, Director of VR & Online Learning, ITI: grant@iti.com

3. Participate in a live demonstration of a VR training module.

See firsthand what is possible with VR. We also recommend having one of your operators participate in a live demonstration. Set up a demonstration at <https://www.iti.com/vr/demo>.

4. Determine how VR may best be incorporated into your current training method(s).

Some companies may find it better to have VR in house, while others may choose to send people to a hosted training event off-site.

5. Conduct trial training.

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