How INVISTA's Transforming Manufacturing Training with Virtual Reality

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Abstract

Can VR training improve manufacturing? It definitely can. In 2019, INVISTA came to Circuit Stream with a problem. Their current training model of slides and job shadowing was taking them months to train employees—six months actually.

What was more, once the employees were trained, they often still didn't have the hands-on experience needed for technical and skills-based roles. INVISTA was spending hours of manpower and losing valuable operational time while teaching new recruits. Plus, materials put toward training were thrown out; creating waste in the process.

This is where Circuit Stream came in. Circuit Stream applied its process for VR training to help INVISTA reduce costs while creating a faster, safer, and more engaging training experience. Read on to learn about the project's transformational results.

Keywords

VR · Virtual reality · Oculus quest · Enterprise · Training · Innovation · Manufacturing · Circuit stream · INVISTA

1 Company Description

Circuit Stream is a leading provider of augmented reality (AR) and virtual reality (VR) education, development and software services. Established in 2015, the company has built an ecosystem accelerating the adoption of AR/VR technology through

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three core pillars: (1) training courses, (2) software development services, and (3) an enterprise platform for scaling AR/VR applications.

The company serves the $6.3B AR/VR training market driven by large enterprises across multiple verticals. Through its educational and development services, Circuit Stream supports technical teams in developing the skills to build and use AR/VR technology. Its enterprise platform scales these solutions, solving common friction points and standardizing AR/VR learning protocols with analytic capabilities and demonstrable return on investment results. To date, the company has trained over 30,000 professionals across North America and has worked with some of the world's largest organizations including Koch Industries, VMWare, Global Foundries, Anglo American, Lockheed Martin and the US Navy helping them build internal skills and scale AR/VR adoption.

One of the company's Circuit Stream works closely with is INVISTA, one of the world's largest producers of chemical intermediates, polymers, and fibers. Headquartered in Wichita, Kansas, INVISTA has a presence in more than 20 countries. From the fibers in carpet to the plastic in automobiles, INVISTA's commitment to continuous improvement has led its employees to develop some of the most durable, versatile polymers and fibers in the world. A subsidiary of Koch Industries since 2004, INVISTA brings to market the proprietary ingredients for nylon 6,6 and recognized brands including STAINMASTER®, CORDURA® and ANTRON®. INVISTA also offers specialty chemical intermediates and process technologies.

2 Project Summary

Can virtual reality (VR) training improve manufacturing? It definitely can. In 2019, INVISTA came to Circuit Stream with a problem.

Their current model of traditional classroom training and job shadowing was taking them months to train groups of new employees, six months to be specific. Additionally, once the employees were trained, they still didn't have the hands-on experience needed for technical and skill-based roles. New groups of trainees, which were typically in the low double digits, were brought into the company multiple times throughout the year to conduct training for numerous operational roles, creating a significant opportunity for INVISTA to improve its technical training.

Using a traditional training model, INVISTA was spending months of manpower and losing valuable operational time, plus the materials used during training were often discarded, creating waste in the process. This is where Circuit Stream came in. Circuit Stream applied its process for VR training development to help INVISTA reduce costs while creating a faster, safer, and more engaging training experience. Read on to see the transformational results INVISTA and Circuit Stream experienced by implementing VR training in a manufacturing environment.

3 Project Details

INVISTA and Circuit Stream's work on virtual reality started when the site in Camden, South Carolina wanted to revamp its spinning technician training, a skilled role in which employees wind molten fiber around a complicated system of spools to stretch and strengthen it.

When performed correctly, the fiber is cooled through a combination of water and air and ultimately threaded onto several large spools. When the spools reach their final size and weight, they are removed from the machine and loaded onto a pallet where they will be shipped 'downstream' to another manufacturer. The spools of yarn will ultimately be used to make many everyday consumer products including things like carpet, car materials and even clothing.

But before the product gets into the hands of consumers, or even to the downstream manufacturer, INVISTA must ensure that their product is produced consistently, efficiently and most importantly safely, all results which stem from a highly effective training process.

String-up training itself can be difficult, time-consuming, costly and potentially dangerous for someone who is untrained. One of the biggest challenges in training new employees is that trainers had to wait for a filament to break before teaching a trainee how to restring it because there was no better way to practice than on the actual machine, and no training available that was similar to it. And in order to get the machine running again as soon as possible, training sessions lasted only 30 minutes. New employees needed six months on average to reach proficiency. "It really wasn't effective or efficient," one of the trainers, Robert Ray, said. "There was a lot of wasted time and frustration."

Dane Laughlin from INVISTA's innovation team sitting alongside some of the devices they are exploring and using. He shares more information about the VR training program in a video here: https://www.youtube.com/watch?v=vccyFPOOC4s

INVISTA's innovation team had been interested in virtual reality for a while, so when the Camden site asked if there were any ways to improve training, they jumped on the idea. A VR environment is more conducive to learning—instead of spending short bursts on a factory floor, trainees complete the simulation at a self-directed pace in a quiet room.

Repurposing one of the conference rooms, the Training team set up a permanent VR Training Center where new employees would engage with VR-based learning environments during their onboarding for many technical roles. With the goal of creating the highest fidelity experiences possible, the team installed several Valve Index VR headsets in the space, along with the corresponding hardware, and forecasted bringing dozens of new trainees through the center every year.

While the hardware was being installed, the next step was to design the experience. After extensive discussions with current employees, the team created a training simulation that incorporates visual cues as trainees "work" on the spinning machine. Check and information marks pop up to indicate what step comes next or warn that a task is incomplete. VR makes training less fraught because it eliminates the risks associated with untrained hands working on equipment using molten fiber and fast-moving components.

A user completes one of the steps in the VR simulation and is presented with the next task

It took about 90 days to develop the VR simulation, and there were some bumps along the way. At first, the team thought trainees should use an actual "string-up gun" while practicing with the VR headsets in the training room at the Camden facility. "But then we realized that four people swinging poles around in a facility training room while blindfolded wasn't a great idea," Dane Laughlin from the innovation team laughed (Koch Newsroom, 2020).

4 Feedback from End Users

The new system, which launched in November 2019, has the potential to cut training time in half. One huge benefit is that trainers can teach a whole group at once. It's also now possible to use one person's mistake as a teachable moment.

"It's so much more nuanced," Robert said. "You can show people that if they just tweak how they're moving their hand 10 degrees, it makes everything so much easier. That just wasn't possible when we were moving fast and yelling over the factory floor noise."

The training has had some unexpected benefits. The VR program turned training into a friendly competition, with employees wanting to be better and faster than their fellow trainees. That's in part because Circuit Stream's VR platform allows the company to capture detailed, real-time data on how well each trainee is mastering the work.

Data collected during training includes the completion rate by step, the average time per step and session, and the unique active users and sessions over time. Additionally, the Circuit Stream SDK (software development kit) and Platform collect and transmit more granular training data in the form of xAPI statements.

xAPI is a new e-learning specification that makes it possible to collect data across a range of technologies and experiences. A generalized example is that the xAPI system turns every learning behaviour into an actor (John), verb (turned), and object (the dial).

This new data format is great for interpreting simulations, such as AR/VR training, because it can measure specific behaviours and context. In the case of training for manufacturing equipment, this includes measuring a variety of metrics from within the simulation itself. Things like hazards (e.g. if an employee is too close to parts of the equipment that are extremely hot or spinning at a high velocity), what equipment the trainee is interacting with at each stage of the process, and even where the user's eyes are looking.

The outputs captured in the AR/VR application are expressed in xAPI formatted statements that are transmitted to a company's LRS (Learning Record Store), which is a specialized database conceived specifically to store and transmit xAPI data to other business systems, and ultimately consumed either in a LMS (Learning Management System) or other business intelligence tool.

This new way of capturing data enables vastly more insights for training managers and organizations to interpret how training is being performed and its effectiveness in more realistic and intuitive ways as compared to traditional methods.

"In the past, we had no objective way to measure a trainee's preparedness," said Adam Brooks, INVISTA IT business systems analyst. "Now, trainers can see where individual trainees are falling behind. They can aggregate data to determine which steps are more accident-prone, and take steps to mitigate the danger."

The VR training also has cut the time it takes for current employees to transition from one machine to another, so it's easier for them to switch jobs if they or the company need a change. Longtime employees have marveled at the VR training, with many joking new trainees "have it easy." Those trainees, meanwhile, have a hard time imagining learning any other way.

5 Future Outlook and Road Map

Next up for INVISTA's Innovation and Training team is an effort to scale VR training by putting it in the cloud, giving any site around the world access. Using a cloud-based approach coupled with a VR simulation is a prime example of INVISTA's goal to encourage employees to harness new technology to evolve their roles and processes for the better, said Steve Daley, president of Koch's Market-Based Management capability, which is responsible for cultivating an environment of continuous learning and transformation across Koch's worldwide facilities and nearly 130,000 employees. "Koch employees are using technology to facilitate learning and improved knowledge sharing to increase the rate at which we transform how work is done."

"This first VR program marks the beginning of a new chapter for INVISTA, now that the company can fully immerse a trainee," Brooks said. "We can run them through situations and scenarios, over and over again, without any risk and without any waste."

It's why the team now is developing more virtual reality training programs for other operational, health and safety tasks as well as various procedures throughout the company's many manufacturing facilities. INVISTA is also working on augmented reality for guided work instructions and remote assistance. In short, they want to turn as many costly and cumbersome processes into VR as they can to improve the employee experience. "We're looking at all sorts of other potential use cases," Dane said (Fig. 1).

6 Conclusion

In the end, the results from the VR training speak for themselves, employees are reaching proficiency up to 50% faster, total training time has been reduced by month.

Circuit Stream is developing more VR programs for INVISTA's manufacturing facilities and continues to focus on transforming the training process.

Meanwhile, Dane has been impressing spinning operators with his threading acumen. Recently, while visiting a site, he was challenged to thread a live machine, something he'd never attempted. "It was kind of funny because the whole way, the

Fig. 1 With its first virtual reality training program successfully launched, INVISTA's Innovation team is seeking to scale VR-based training to sites globally. The team is also exploring the use of augmented reality (AR) for providing work instructions and remote assistance. Dane Laughlin is seen above wearing a Microsoft Hololens augmented reality headset

operator was telling me how hard it is to catch the thread to get it started," Dane said. "I was kind of worried. But I had a very strange sense of déjà vu, because I'd never actually done it outside of VR, but I felt like I had. And then it was snip, snip, done! His jaw just dropped. That was pretty cool."

Reference

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