

# Applying a Blended Learning Training Model to Manufacturing

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## ABSTRACT

Professional trainers are familiar with the concept of blended learning approaches. By combining various training media, trainers take advantage of the particular strengths that each approach offers. However, most training discussions focus on generic content.

The unique training needs of companies in the manufacturing sector demand a solid understanding of the advantages of blended learning. Because manufacturers need people with both hands-on ability and knowledge of metalworking theory, a training initiative will likely fail without a blended approach that tackles these components properly.

## THE ESTABLISHED ASSUMPTIONS

It is wrong to assume that hands-on training is the exclusive way to teach manufacturing skills to employees. Even so, community colleges and vocational schools have placed



hands-on work prominently in the curriculum, and in some cases made it the entirety of their programs. But while such an approach trains the student to use a machine properly, it neglects the fundamental concepts behind using that machine. Hands-on training alone does not adequately prepare a student for tasks or concepts beyond a specific machine or process.

Among educators, there has been a growing consensus that the most

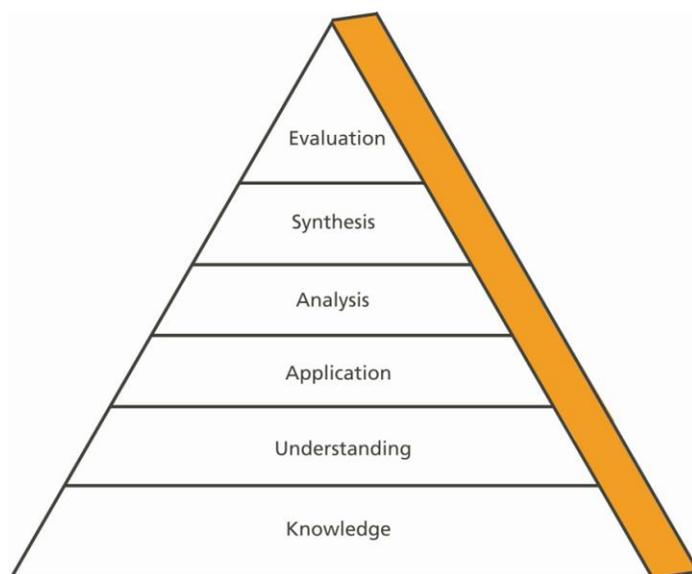
effective training combines hands-on work with theory-based education. This instructional approach is called blended learning. Blended learning combines different media to create a more valuable training experience for the student. Through blended learning, a student not only becomes skilled at a specific process, but also understands the theory and reasoning behind it. This enables the student to apply his or her knowledge in a broader context and situations of greater complexity.

Blended learning is not new. Rather, it is a new term for the methods that good teachers have used for years. In the past, blended learning meant a combination of instructor-led classes and outside materials such as books and hands-on experience. Today's blended learning methods have replaced textbooks with content delivered in electronic format through an internet or intranet portal. This online component of training is often referred to as e-learning, web-based training (WBT), or online training.



Online training has many advantages. One of the primary advantages is the "portability" of the virtual classroom. Through online classes, students have access to instructional materials anywhere there is a computer with an internet connection. After reviewing the online lessons, students can complete their training with hands-on experiences in the very shop where they will be applying the necessary skills.

Online training is both convenient and cost effective. For the price of a computer, a basic network, and course content, an organization can deliver the same amount of instruction as an offsite, instructor-led class. However, online training alone cannot meet all the training needs of an organization. Effective learning requires "a combination of content plus context. Content is meaningless unless it is fit into the context of the business challenge, the learner's abilities and background, the work environment, and the specific learning objectives." <sup>1</sup> Blended learning addresses both content and context.



Content and context can be broken down into specific levels of Bloom's taxonomy. Widely used by educators in all fields, Bloom's taxonomy is a hierarchy of cognitive skills required for students to learn a concept. As shown in Figure 1, the lower level skills form the base of Bloom's taxonomy, and the upper level skills form the peak.

The online training component of blended learning tends to meet level

1, knowledge, and 2, comprehension. At these levels, students can "remember and recall information ranging from concrete to abstract" and "understand and make use of something being communicated." <sup>2</sup> Hands-on training meets level 3, application. At this level, "students can apply appropriate concepts or abstractions to a problem or situation even when not prompted to do so." <sup>3</sup>

## THE PROBLEMS IN MANUFACTURING

Currently, there are a series of problems in manufacturing that create challenges for companies trying to secure and maintain a well-trained workforce. The first problem is the loss of experienced workers. In the coming years, an entire generation of factory workers will be reaching the age of retirement. This crisis is compounded by the difficulty of finding adequately skilled workers to replace the ones who have retired.

Relatively few students take vocational courses anymore. This is partly due to the negative image that most people have of manufacturing. In a study by the National Association of Manufacturers (NAM), it was discovered that manufacturing jobs were not being accurately characterized and there was little understanding of how much the field has changed. Educators and parents saw manufacturing as a declining job sector that had little relevance to modern times. Alarming, some educators also believed that little, if any, education was required to perform manufacturing jobs. As a result of this negative input, students perceived careers in manufacturing as boring, low-paying, dangerous, and generally best avoided.

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In response, perhaps, to the declining interest in manufacturing jobs, relevant programs in community colleges and vocational schools have also declined. Funding for such programs has often been cut, or current funding cannot meet the demand to purchase modernized machines and materials on which to train.

Rapid changes in manufacturing itself have also contributed to the problem of finding a skilled workforce. The modern manufacturing company seeks to employ people with a range of skills rather than simple "button-pushers." Moreover, new technologies and changes in existing production techniques have required workers to continuously develop their current skills in addition to learning new ones.

At GM's auto plants, for example, electricians used to have fairly basic jobs installing parts and maintaining shop equipment. However, the rising use of computers and other electronics in the day-to-day work of the plant has created a need for many more hours of training. New hires must possess a high level of electrical knowledge, including skills in robotics and in the application of complex diagnostic equipment used in automobile production. As a result, electricians commonly receive 2,500 to 3,500 hours of training in addition to the already extensive apprenticeship program in place.<sup>4</sup>

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Given the complexities of modern manufacturing, training methods that rely solely on classrooms and textbooks quickly seem outdated. Printed reference materials and instructor-led classes deliver content, but these approaches alone do not provide a context for the material. Blended learning, on the other hand, gives companies customizable approaches and strategies for training their workforce.

By combining online training, instructor-led training, and hands-on experience, companies are able to keep up with modern advances in technology, as well as increasing regulatory changes that have a direct impact on the shop floor. In addition, with government support and pressure for greater education of the workforce, companies are finding that having a certified training program enables them to meet the challenges of modern manufacturing.

## **THE MANDATE FOR MANUFACTURING: WHAT MUST TRAINING ENTAIL?**

Like all companies operating in a global economy, manufacturers must constantly look for ways to decrease costs and improve productivity. A key factor in remaining competitive is the quality of a company's workforce. Employers look to hire talented and self-motivated workers who can learn many different skills and concepts and incorporate them on the shop floor. Where a worker was once expected merely to execute a job, today that person must also be educated in theories relevant to that job, must be able to troubleshoot problems when they occur, and must contribute to quality.

A training model that includes both theory and practices is best addressed through blended learning. Blended learning ensures that at least the first three levels of Bloom's taxonomy—knowledge, comprehension, and application—are covered. The online training and instructor-led portions of blended learning help students develop knowledge and comprehension of a subject, while hands-on training allows the student to apply that knowledge to applications on the shop floor.

Bloom's taxonomy is a powerful tool in instructional design. A program that follows Bloom's taxonomy teaches a student to solve problems of increasing levels of complexity. It also addresses different learning styles. Individuals learn in ways that are unique to each of them. Some learn by seeing, others by hearing, and still others by doing. A person may use only one style, or a combination of two or three. By using different media, a blended learning approach to training addresses all learning styles. Instructor-led training appeals to auditory learners and hands-on training appeals to kinesthetic learners. Online training appeals to visual learners, while at the same time incorporating audio and simulations that appeal to auditory and kinesthetic learners.

## THE MANUFACTURING TRAINING SOLUTION

Job competencies are yet another driving force behind employee training. Standards for job competencies can be internal to the company, or externally mandated by an organization such as the Manufacturing Skill Standards Council (MSSC), the National Institute for Metalworking Skills (NIMS), and American Welding Society (AWS).

The NIMS credentialing program requires that the candidate meet both performance and theory requirements.<sup>5</sup> NIMS divides their standards into two areas: KSAOs (knowledge, skills, abilities, and other characteristics) and occupational duties. For example, to be certified in Level II and Level III machining, a worker must have knowledge in basic arithmetic and geometry, as well as the ability to take measurements and read blueprints. On the shop floor, he or she must be able to perform job duties such as tooling maintenance, parts inspection, and process control.

While some standards may propose a “theory only” curriculum, most standardized training for manufacturers propose a curriculum that balances theory with demonstrable hands-on skills. This type of training is inherently blended. For example, in order for a worker to successfully complete NIMS certification, individuals must produce a part that is validated as a quality part (hands-on) and also pass an exam to verify retention of knowledge (theory). For professional welding, trainees should be expected to know the theory behind proper joining, and also demonstrate the ability to produce a quality weld.

The online training portion of a blended learning program can familiarize workers with the terminology and concepts that are widely becoming industry standards. While one-on-one training on a given process can bolster the techniques needed to complete that task, oftentimes workers are not exposed to the proper terminology and theories surrounding a machine or process. Not only does such a specific understanding of language enable the worker to achieve certain competencies, but it standardizes communication between workers, which helps to limit miscommunication in the future. Blended learning is key in providing a worker with such knowledge, and ensuring that the person retains it (through such means as online testing) so that certification tests will

be easier. The content offered in a blended learning sequence can be customized to address the needs of a student working towards any range of certifications while also paying attention to any information specifically important to an individual company.

Online training is an excellent medium for teaching theory as well. First, it guarantees that the information provided to students is consistent: all workers receive the exact same lessons. This allows employers to more accurately measure the performance of their workforce. They know exactly what each worker is being taught, and therefore can set consistent expectations for that worker.

Another advantage of online training is accessibility. Online training programs can be used by any number of students at once. The content is available both inside and



outside of the classroom, and can be covered at a pace the student dictates. In the classroom, broader topics can be addressed by an instructor with the full knowledge that after the class, a student will be able to view the specific aspects of the topic that apply to his or her particular job. Moreover, students can review online content to refresh their knowledge of a topic.

Online training providers must be conscious of industry standards such as NIMS and must design programs with those standards in mind. Through the use of a Learning Management System (LMS), companies can track how well students are doing when compared to industry standards.

## REASONABLE EXPECTATIONS FOR MANUFACTURING ONLINE LEARNING

Many employers know that they need to train their workforce but they do not know where to start. Offsite training is often expensive and unproductive. Employers need a training program that is convenient, customizable, consistent, and cost-effective. Tooling U provides such a solution through online classes developed specifically for manufacturing.

First, Tooling U provides assessment tests that give employers a blueprint for where training should be focused. The assessment tests are organized around specific job

titles. If the standard assessment does not meet the requirements of a company, Tooling U can create a customized assessment that meets the client's specifications. Companies like GE, Greico, and Dixie Iron Works have all benefited from customized assessments by Tooling U.

Once a company has identified skills gaps in its workforce, Tooling U can assist with developing a training program to close those gaps. Tooling U's content delivery system is driven by customer needs. Classes are small and digestible and can be completed in two hours or less. A content editor feature allows classes to be customized to include information specific to the company, making it possible to contextualize information.



Tooling U classes are designed to enhance the student's learning experience, with text, graphics, audio, video, and interactive Flash exercises. Students can use an interactive notepad and instantly get definitions by placing the cursor over a vocabulary word. There is even a voice-over feature for auditory learners, or for students who have difficulty reading. The content can also be downloaded as a .pdf so the

student can access the material offline. Although blended learning approaches recognize that certain media is appropriate for different learning styles and learning objectives, online training provides a robust multi-media delivery method that helps to address a wide range of learner requirements.

A good training program also includes a learning management system (LMS) for tracking competencies and developing career paths for workers. The Tooling U LMS provides human resources with the tools needed to track employee performance and empowers students by allowing them to set personal goals. Tooling U can assist employers in scheduling classes, setting up a series of web-based classes for students to complete, providing reference materials for instructors, and providing tracking of offline materials that are used in the classroom and on the shop floor.

Across the business spectrum, online training is proving to be incredibly effective. Students have demonstrated a clear gain in knowledge when compared to "offline" training programs. For example, Office Depot found that workers who went through their online training program retained 25% more knowledge while costs went down 80%.<sup>6</sup>

Tooling U is no exception to this trend. The following case studies outline the benefits that companies have seen by using Tooling U as the online training piece of a blended learning program.

## **CASE STUDY: POLARIS CAREER CENTER**

Polaris, a leading career and technical training facility for high school and adult students located in the Cleveland, Ohio area, formed a partnership with Tooling U to rejuvenate their courses in engineering, manufacturing, and machining. Polaris's new courses blended face-to-face instruction in both theory and laboratory settings with online classes used on laptops provided to the students. Assessment took place on an ongoing basis against a continuum of scaffolded state and industry standards, including NIMS, yielding remarkable results in comparison with students who were in the older program.

Each student at Polaris attempts to master several hundred competencies over the course of two years. The junior students in the program in the fall semester mastered from a low of 94 to a high of 134 competencies, whereas students not participating in the new program achieved between 54 and 112 competencies. As a group, the technology-engaged group achieved 1774 competencies, 38% more than the non-blended learning program. Similar and even greater improvements are noted in the areas of letter grades (45% more As and Bs), discipline (100% drop in discipline referrals), and attendance (20% drop in truancy).

## **CASE STUDY: PARKER HANNIFIN**

Parker Hannifin is a world-class manufacturer of motion and control technologies and systems. Parker Hannifin approached Tooling U following their realizations that their on-the-job (OTJ) training was not standardized and risked perpetuating bad habits from one generation of employees to the next. Workforce promotion and attrition led to openings and incoming workers that needed to be trained, but the technical schools that would normally fill this training need were fewer in number, were relatively far from the worksite, and did not offer online training.

Tooling U helped Parker Hannifin set up a training program in CNC operations as well as basic shop concepts. Parker Hannifin established a quiet training room equipped with six laptops that employees accessed before work, during lunch, and after work, but some employees also used their own computers to access courses from home.

Employees were compensated for participating in the training, whether at home or at work.

Students found the classes “valuable and useful” and liked that they “controlled [their] own destiny” during their training. Students reported using the “Notes” feature, with many of the students printing material to have on hand for future reference. Students also felt that the classes were suitably interactive and provided sufficient multimedia presentations that assisted in learning the material.

To varying degrees, all employees have been using the training offered, and one employee took all available classes offered, resulting in increases in this employee’s efficiency and productivity.

## **CASE STUDY: ROCHESTER MEDICAL IMPLANTS**

Rochester Medical Implants (RMI), a contract manufacturer of medical implants for the orthopedic industry, initially had several issues with employee training. The most important areas that needed to be addressed included quality issues, as well as an unclear baseline for running the CNC equipment. Prior to their involvement with Tooling U, RMI also had no assessment testing, and thus no way to evaluate or establish baseline knowledge for new and current employees.

RMI set up a dedicated classroom area with desks and computers. Employees were encouraged to study only on company time so their work could be monitored and additional resources could be accessed if necessary. Rather than reducing the workforce during a slow business period, RMI used Tooling U training during the downtime to train people and build job skills.

Students expressed positive feedback about the blended learning experience, emphasizing the program’s ease of use and immediate feedback, as well as the ability to review work and collaborate with others. From an administrative point of view, employee knowledge and skill levels improved. RMI noted that the Tooling U program allowed them to track student progress, test scores, and number of attempts at passing a test. Also, administrators could intervene with additional help and resources if necessary. Following the training, it became evident to RMI management that employees now knew everything they were required to know to better perform their job functions.

## CASE STUDY: TORO

The Toro Company is a leading worldwide provider of outdoor beautification products, support services, and integrated solutions. Prior to Toro's involvement with Tooling U, candidate employees were given paper tests to assess their abilities. Candidates are now given an evolved Tooling U custom assessment that tests necessary core knowledge requirements specific to Toro. This assessment also addresses the trend among technical colleges of dropping many of the basic skills courses because machine trades are increasingly considered "non-essential."

In addition, Toro trainees completed the Tooling U training at home and took final exams at the Toro facility where they could be more closely monitored. The students were compensated for their online learning time based upon a scale agreed upon with the Union.

The training developed by Tooling U has helped to drastically reduce Toro's training costs. Most recent estimates include an approximate \$81,000 annual savings. Student feedback was generally positive and focused on convenience, ease, and accessibility of taking the classes. Many students also took full advantage of their subscriptions and enrolled in additional classes that they were encouraged to take from the approved list.

Toro developed an apprenticeship program, based on specific classes as well as other training, which required each student to obtain a minimum of 4 credits (with each credit worth approximately 32 hours) for completion. Tooling U's software allowed the training administrator to establish specific parameters, which helped define the expectations with regard to job performance. Students were required to achieve a score of at least 70% to pass and were allowed a maximum of three attempts to pass it. By using these methods, Toro created an effective training program based on blended learning concepts that brought unique synergies to the training process.

## CONCLUSION

For manufacturers, the blended learning training model yields results. It addresses different learning styles and combines theory with practice. The online component of a blended learning program offers unique flexibility and can be used to supplement almost any type of training program. In particular, online content can be used to help workers prepare for industrial certifications or company-specific competency models. Tooling U develops online classes specifically for the manufacturing sector and provides the tools necessary to assess a company's training needs. Case studies have shown that a

blended learning program that includes online training from Tooling U helps workers to achieve the job competencies required in today's industrial workforce.

## Notes

1. Josh Bersin, *The Blended Learning Book: Best Practices, Proven Methodologies, and Lessons Learned* (San Francisco: Pfeiffer, 2004), 9.
2. Charles M. Reigeluth and Julie Moore, "Cognitive Education and the Cognitive Domain." In *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory*. Vol. 2 (Mahwah: Lawrence Erlbaum Associates, Inc., 1999), 52.
3. Ibid., 52.
4. Robert Sherer and others, *Capital Area Manufacturing: Past, Present and Future* (Lansing: Capital Area Michigan Works!, 2004), 9-10.
5. "About NIMS." National Institute for Metalworking Skills, Inc. (NIMS, Inc. 2005), <http://www.nims-skills.org/about/about.htm>.
6. Karl M. Kapp and Carrie McKeague, *Blended Learning for Compliance Training Success* (EduNeering, Inc., 2002), 9.

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