

# **Simulation and Blended Learning for Professional Education in the Medical Device Environment**

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## BACKGROUND

Thanks to globalization and rapid advances in technology, the medical device manufacturing environment has become extremely competitive. Large and small companies alike are looking for training programs that will provide learning solutions to improve the bottom-line results. This includes programs that improve operational processes, recognizes problems rapidly and systematically and reduces waste and cycle times.

Using a blended learning approach is not only cost effective since it reduces learning time and increases retention rates, but it can also provide a completely new set of learning tools, such as simulation, in order to provide the best learning environment possible. By implementing blended learning strategies that include simulation, medical devices can be introduced onto the market much faster due to shorter training cycles. The following pages will review key learning concepts, instructional modalities and technology platforms that, when integrated with a consistent strategy, will help medical device companies achieve their educational goals and reduce learning time.

## LEARNING THEORY – KEY CONCEPTS

### Knowledge Skills and Attitudes (KSAs)

In order to create the best learning solution, it is important to become aware of what constitutes a good learning experience. Learning specialists have identified specific terms that describe the full range of human functionality and performance. For the purpose of this discussion the term KSA (knowledge, skills, attitudes) will be used to summarize the three main domains of learning activities.

- *Knowledge* refers to information, usually factual or procedural, which makes adequate performance on the job possible.
- *Skills* refer to manual or physical skills needed for proficient job performance.
- *Attitudes* refer to the emotional skills needed to choose appropriate courses of action (i.e. you always choose to treat others in a respectful manner – even if they are subordinate).

The KSA skills required to perform a given task tend to be hierarchal in nature. In other words, we usually need to master the easiest, basic KSAs for a given task before we can master the whole task. For example, even a simple task of “correctly tying a shoe” requires one to be able to correctly identify a shoe and shoelace, learn the procedural steps, perform the steps, and then be able to discriminate between a correctly tied shoe and one that is not correctly tied.

If we look at a much more complex task such as “correctly performing a hysteroscopic myomectomy”, the hierarchal nature of the task is more obvious. It becomes even more important to master the lower level KSAs to correctly perform more complex tasks. When elements are attempted to be taught all at once, learners often end up frustrated and the learning subpar.

When mastering KSAs, speed is not necessarily a predictor of future performance. All people learn at their own rate, and fast learning doesn't necessarily result in better performance. Therefore, learning solutions that allow people to learn at their own rate tend to be very successful both in terms of user satisfaction and end results.

## **Contextual Learning**

Mastering a given task is often dependent on detecting and reacting to sensory cues (sight, sound, touch, etc.). As we learn a task, the information regarding the cue is stored in memory along with the procedural information on how to perform the task. In the medical industry, real life scenarios are not always possible. An effective alternative is high-fidelity simulations which help learners achieve mastery in performing complex tasks that are otherwise impossible to replicate during the learning experience. For example, a simulator can be used to explore medical procedures in a safe environment by providing hands-on training with surgical tools to enhance true-to-life feel of tissue resistance during surgery simulation. Without the lengthy process of setting up actual medical procedures, students walk away with real-life learning experience in a very short amount of time.

## **Reinforcement**

We know that correctly practicing a task is a key component of any strategy to achieve mastery. Practice reinforces the storage and recall of information in long-term memory and enhances learners' ability to perform complex tasks without having to consciously focus on each individual element of the performance. We also know that practice over a longer period of time tends to be more effective than all at once practice, so it is important to provide learners multiple opportunities for practice items to be mastered over a staggered time period.

Much has been written on the influence of those we consider to be our peers in terms of the impact in creating and maintaining group "norms." In addition, it has also been well documented that when peers work together, they are more likely to solve difficult problems and accomplish difficult tasks than they would otherwise working as individuals.

Another aspect of our social nature is the impact of "human models" on learning behavior. A mentor can be a model if the mentor behaves in a way that appeals to a learner. When that occurs, it can be a very powerful and motivating influence on behavior and performance. Mentors, who are perceived to be competent and have prestige/power, tend to be the most influential. Thus, the appropriate use of peers and models can have a powerful impact on the effectiveness of any training programming.

## **Motivation**

All learners need to be motivated to learn, and this is especially true with adults. What follows are the primary elements of motivation in adults. These elements should be carefully considered during all phases of the instructional program:

- *Attention:* If learners do not open their senses and attend to the learning material, learning will not occur.
- *Relevance:* Learners must feel that what they are being asked to learn is relevant to their situation.
- *Confidence:* Learners must be confident in their own ability to master the material, and they must be confident in the competence of the instructors and the accuracy of the instructional material.
- *Satisfaction:* Learners must have a sense of accomplishment and fulfillment.

## **Synergetic Approach**

Synergy occurs when the sum of the components of a learning solution are greater than that of its individual parts. Synergistic systems generally have the following qualities:

- There are clearly defined goals
- There is a feedback mechanism that monitors system performance relative to the system goals
- There is a directing mechanism that translates the feedback into action

The components that make up a synergistic system apply to both the system that makes up an instructional event (present the material, provide learning guidance, allow for practice, provide feedback and assess) and to the larger instructional strategy in which the instruction occurs.

## **BLENDED LEARNING – KEY CONCEPTS**

Blended learning can be described as a learning program that includes different approaches to attain the best learning solution. The prime objective of this approach is to optimize the learning outcomes in order to reduce the time needed to complete the training cycle; therefore, this approach results in shorter product to market adoption times. Blended learning solutions may include face-to-face instruction, eLearning and mobile learning, simulations and games in varying degrees.

According to a study completed at the Centre for Academic Transformation in New York by Twigg, C.A., goals achieved by blended learning include increased class completion rates, better retention, improved student attitudes toward the learning material, and increased student contentment with the mode of instruction compared to traditional formats.

### **Types of Blended Learning**

A blended learning program may combine one or more of the following dimensions, although many of these have over-lapping attributes:

#### *Blending Offline and Online Learning:*

At the simplest level, a blended learning experience combines offline and online forms of learning. An example of this type of blending may include a learning program that provides study materials and research resources over the Web while providing instructor-led, classroom training sessions as the main medium of instruction.

#### *Blending Self-Paced and Live, Collaborative Learning:*

Self-paced learning implies solitary, on-demand learning at a pace that is managed or controlled by the learner. Collaborative learning on the other hand implies a more dynamic communication among many learners that brings about knowledge sharing. The blending of self-paced and collaborative learning may include review of important literature on a regulatory change or new product followed by a moderated online, peer-to-peer discussion of the material's application to the learner's job and customers.

#### *Blending Structured and Unstructured Learning:*

Not all forms of learning imply a pre-meditated, structured or formal learning program with organized content in a specific sequence like chapters in a text book. In fact, most learning in the workplace occurs in an unstructured form such as meetings, hallway conversations and e-mail. A blended program design may look to capture active conversations and documents from unstructured learning events into knowledge centers available on-demand, supporting the way workers collaborate and work.

## **Ingredients of the Blend**

In the past, the ingredients for blended learning were limited to physical classroom formats (lectures, labs, etc.), books or handouts. Today organizations have many learning approaches to choose from, including but not limited to:

### Synchronous physical formats:

- Instructor-led Classrooms & Lectures
- Hands-on Labs & Workshops
- Physical Simulators
- Field Trips

### Synchronous online formats (Live eLearning):

- Virtual Classrooms
- Web Seminars and Broadcasts
- Coaching and Mentoring
- Instant Messaging

### Self-paced, asynchronous formats:

- Documents & Web Pages
- Web/Computer-Based Training Modules
- On-line Simulation
- Assessments/Tests & Surveys
- Recorded Live Events
- Online Learning Communities and Discussion Forums

While instructor-led activities and faculty coaching have been extensively implemented in the practice of professional medical education, the role of simulation and clinical practice communities in creating effective instructional solutions merits some further discussion:

### The Role of Simulation

Knowledge alone is not sufficient to make a well-rounded clinical practitioner. Clinical practitioners, such as surgeons, also must be able to choose the correct problem-solving method as well as decide when the solution should be implemented. By using medical simulators, learners can practice the skills they need to know at a very fast pace.

In this context simulation provides an important bridge between knowledge and practice. Simulations can enable trainees to acquire, integrate and, subsequently, “automate” important KSAs such as procedural steps, motion efficiency, spatial judgment and operative decision-making in a risk-free environment, without jeopardizing the patient.

Automating skills through simulation not only allows learners to gain required proficiency, it also allows trainers to monitor the process closely and intervene if necessary. Simulations can provide the environment where learners can go back and relearn necessary skills without costly practice and unnecessary safety concerns to the patient.

### The Role of Collaborative Learning

Engaging in a virtual learning community enhances the instructional environment since the learning that evolves from these communities is collaborative and social in its nature. By working together, learners are able to increase their pool of knowledge much more effectively than learning as an individual. Typical community sharing within the learning environment encourages an

“apprenticeship” model where novices learn best practices from experts. This type of interaction is far more credible to the learner than simply reading about solutions in a textbook.

Continuous social interactions help trainees to learn “how to be in practice” rather than just learning “about practice”, thus facilitating faster transition of knowledge and skills gained through instruction into the clinical environment.

## **The Benefits of Blending**

The concept of Blended Learning is rooted in the idea that learning is not just a one-time event but rather a continuous process. Blending instruction provides various benefits over using any single learning delivery type alone:

### Improved Learning Effectiveness

Recent studies give us evidence that a blended learning strategy actually improves learning outcomes by providing a better match between how a learner wants to learn and the learning program that is offered. Research shows that students are more satisfied with a blended approach, and this satisfaction increases over time. This finding indicates that learners become more efficient at blended learning the more they are exposed to it.

### Extending the Reach

A single delivery mode inevitably limits the reach of a learning program or critical knowledge transfer in some form or fashion. For example, a physical classroom-training program limits access to only those who can participate at a fixed time and location, whereas a virtual classroom event is inclusive of a remote audience, allowing the learning to take place at different times convenient to the learner. This approach helps to shorten the learning cycle.

### Optimizing Training Results

Blended learning initiatives lead to exceptional results. Learning objectives can be obtained in 50 % less class time than traditional strategies. Travel costs and time have been reduced by up to 85%. Acceleration of training delivery to customers can significantly shorten product adoption cycles and have a profound impact on the organization’s bottom line.

### Optimizing Development Cost and Time

Combining different delivery modes has the potential to balance out and optimize the learning program development and deployment cost and time. A hundred percent online, self-paced, media-rich, web-based training content may be too expensive to produce (requiring multiple resources and skills), but combining virtual collaborative learning forums and coaching sessions with simpler self-paced materials such as documents, case studies, recorded live eLearning events, text assignments, and PowerPoint presentations (requiring quicker turn-around time and lower skill to produce), provides faster learning cycles at a much lower development cost.

In summary, blended learning is not only more time and cost effective, but provides a more motivating way to learn and allow knowledge transfer to occur in a more natural way. As a state-of-the-art company in the current medical field, in order to implement the highest level of instruction possible while staying within realistic budgetary concerns, a program based on blended learning design and simulation can raise a company from mediocrity to cutting edge, allowing the products to reach the marketplace at a much faster pace.

## **SIMBIONIX LEARNING TECHNOLOGIES**

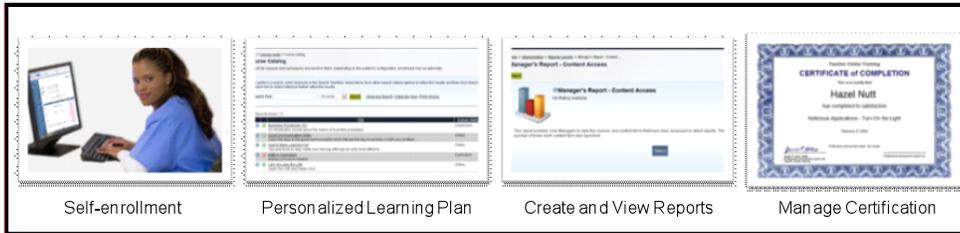
Simbionix offers a platform of blending learning and simulation technologies that have been researched and highly developed in the medical arena and training and development fields. The simulators at Simbionix, when integrated into a systematic blended learning program, improve the

technical skills of the learner by providing activities that are closely aligned to the real-life situations the learners will eventually encounter.

Simbionix medical simulators are created in partnership with national and international medical experts who play an active role in simulation design, content creation, and product testing and validation. Collaboration with top professional societies, credentialing boards and academic institutions around the world are all part of launching simulation based learning solutions and meeting certification requirements. Using the research based strategies of learning theory, the results of Simbionix simulators are the most dependable, motivating and effective medical education training products on the market.

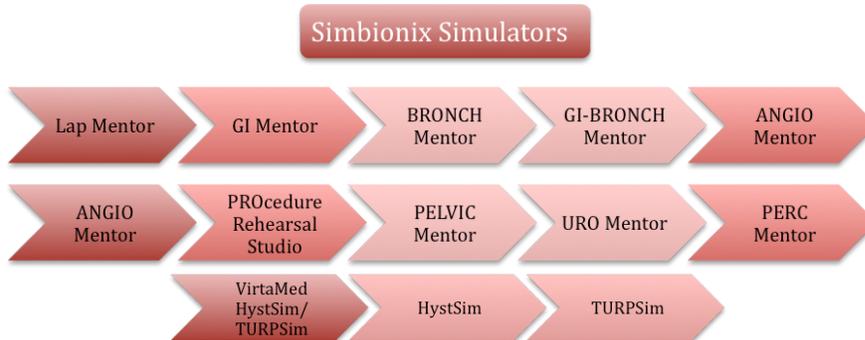
The following simulation and learning technologies are available for individualized instructional programs that are tailored for specific learning needs; these include Simulators, Clinical Practice Communities, and Interactive Content.

### Simbionix- Simulators



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**Comment:** A graphic of some simulators would be good here

Our Simbionix mentor medical simulation series is a complete multidisciplinary training curriculum that enables new or experienced surgeons to practice everything from perfecting basic surgery skills to providing unlimited scenarios of higher level procedures that occur in real life clinical settings. Used independently or integrated into training programs, the mentor series has been validated as an effective and valuable training tool for improving clinical performance and enhancing patient safety. The simulators deliver tactile feedback for realistic experience during the learning process. Simbionix makes a wide variety of simulators, covering many of the medical training areas that are benefitted by simulations.



### Key Features

- Fully procedural training with medical procedures adapted for simulation
- Custom-built feedback reports and scoring system facilitates learning
- Portable and easy setup

### Potential Uses

- Initial contact with learners at tradeshow, lunch and dinner programs
- Physician intensive training on simulator
- Residency programs

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**Comment:** Please let me know if there are other key features you want listed

## Simposia – Clinical Practice Communities



Expanding on Simbionix's mission to advance clinical performance, the Simposia<sup>SM</sup> Clinical Practice Communities help physicians become more proficient and efficient in their practice by integrating training, knowledge sharing and collaboration.

Clinicians can use Simposia to share and review media-rich cases, consult in real time with a trusted network of peers and weigh in on various medical topics relevant to their practice. Members are also able to browse relevant reference material and create and participate in structured educational activities.

The Simposia<sup>SM</sup> community helps to shorten procedure learning times by facilitating physician collaborations with experts and peers, adding critical informal training opportunities to traditional structured training. Designed to support both smart phone and web access, Simposia makes it easy for physicians to access their professional communities and colleagues anytime and anywhere.

### Key Features

- HIPAA compliant, real-time communication
- Structured case discussions, video sharing, live and recorded events
- Learning Management and Event Management integration

### Potential Uses

- Anytime/anywhere case-based training and knowledge sharing
- Just-in-time training and content delivery
- Clinical decision support through remote collaboration

In order to organize the company training, provide a system of evaluation and documentation, and to provide access to the learning opportunities, companies use a learning management system. The Symbionix Learning Management System (LMS) builds on over 10 years of experience in the LMS and Human Capital Management (HCM) industry, supporting some of the largest LMS implementations in the world. The platform manages access to SCORM-compliant courseware, documents, data, instructors, and other learners on-demand. Any material designed to aid job performance is easily and readily available and completely integrated into a single service. The interface is intuitive, attractive, flexible, and very easy to use.

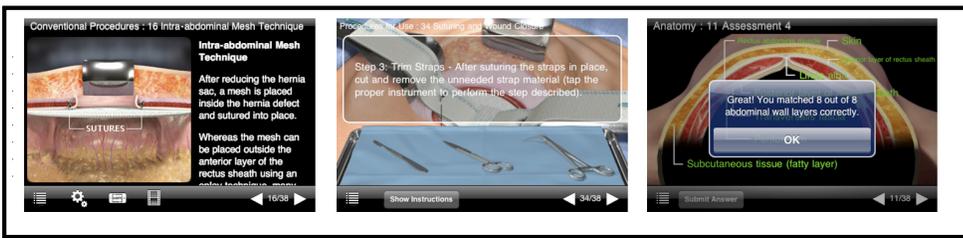
**Key Features**

- HIPAA and 21 CFR Part 11 compliant
- Extended blended learning environment through integration with Simposia
- Enterprise-class, fully hosted solution

**Potential Uses**

- Support and monitor personalized learning plans
- Anytime/anywhere access to training and reference materials
- CME tracking and certification

**Interactive Content**



Computer based training is used to provide remote learning opportunities that are flexible and more realistic than face-to-face training. Symbionix leverages its extensive experience in creating high-fidelity interactive computer based courseware to help its industry partners achieve effective professional education outcomes.

To guide the amount and types of learning needed in each course, we perform a comprehensive topic analysis. This enables us to identify the customer's information or product features, functions, and associated tasks that are considered to be critical to understanding the use of the product or procedures needed to be learned by the user. We then typically rate importance, difficulty, and frequency of use to tailor a unique solution that will achieve desired educational outcomes.

In the context of hysteroscopy training, for example, a potential learning solution may range from web-adapted version of HystSim simulator to mobile interactive animation to screen-by-screen custom courseware.

**Key Features**

**Potential Uses**

- Highly engaging interactive environment
- Anytime/anywhere web and mobile delivery
- Compatible with SCORM and other leading industry standards

- Self-paced learning
- Basic KSA instruction and assessment
- Reference and job-aids

Stefan Tuchschnid 8/18/11 11:24 AM

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## **SAMPLE PROPOSED INSTRUCTIONAL STRATEGY**

### **Instructional System**

The essential part of establishing a viable, sustainable instructional system is identifying the sponsoring organization's strategic goals for implementing the program and translating these goals into Performance Objectives.

Performance objectives are usually defined as the task to be performed to a particular standard under specified conditions (see Appendix A). They also describe the observable behavior we expect from a learner after completing the instruction.

This alignment of the elements of the instructional system from an organization's strategic goals is extremely important on many levels. It focuses and aligns resources and effort with required results, and it provides benchmarks at multiple levels to ensure that not only are the learners on track, but that the instructional system is on track as well.

With its capabilities of managing both the learners, and the system itself, the Symbionix LMS would be a key tool for managing all aspects of the program while monitoring progress and status in relationship to the instructional system's goals and objectives. In addition, LMS will provide monitoring, collating and managing of both instructional feedback (i.e. how a learner is performing in a given instructional event) and systemic feedback (i.e. a progress status of all learners).

### **Instructional Delivery - Major Phases**

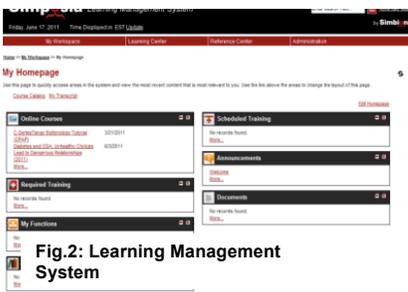
#### Phase 1 – Basic KSAs

Symbionix addresses the blended learning solution for medical device companies in three phases. These phases spiral and build upon each other, increasing learning retention and virtually eliminating the need for retraining. Spiraling the content is a researched-based method that decreases training costs in the long-term due to this higher learning retention.

Phase 1 addresses the basic KSA's initially needed in the first phase of training. Initial instruction will be focused on helping learners to acquire basic knowledge, skills and attitudes that do not require any performance sensory cues other than sight and sound.



**Fig.1: Simposia Communities**



**Fig.2: Learning Management System**

In addition to self-directing learning, we suggest introducing the main components of social learning, such as experts as mentors and the use of peer networking early on in the learning process.

When new learners are brought into the program(s,) he is often assigned a mentor. During the initial instructional delivery phase, the mentor's role is primarily focused on monitoring the learner's progress while providing support and encouragement as required through the tools at her/his disposal (Simposia chats, mobile consults, Adobe Connect sessions etc.)

Learners would be also introduced to the peer network available in the Simposia communities during the initial instructional delivery phase, and it is expected that their involvement with the peer community would be maintained throughout the life cycle of the program and beyond.

**Phase 2 – Advanced KSAs**

Upon successful completion of the initial phase, learners would be eligible to attend a proctored, simulation-based course. Some skills that are focused on during this phase include the following:

- Psychomotor skills
- Spatial orientation
- Device manipulation
- Practical hands-on training of all KSAs learned in Phase 1 (reinforcement, moving the learner from knows-how to shows-how)



**Fig.3: Example curricula – as soon as threshold score is reached next case is unlocked**



**Fig.4: Secure mobile messaging platform**

Mentors could be used to provide learning guidance and feedback during this session. It is recommended that during at least some of these sessions, an attempt be made to replicate the operational environment. This would include clinicians wearing scrubs, gloves, etcetera that are appropriate to the procedure. Course materials will be posted as LOs in Simposia/LMS to provide immediate reference for the attendees and those who couldn't make it.

### Phase 3 – Sustain and Reinforce KSAs

After completing the first two phases, learners would enter a sustainment phase. Trainees will maintain access to immediate reference materials accumulated throughout the training and will shift their focus from instructor/mentor-led learning to peer-to-peer knowledge sharing.

This phase would be categorized by:

- Follow-up advice, and counseling by assigned mentors
- Reinforcement and enrichment through participation in peer networking and scheduled special events
- Special instructional events on advanced topics, delivered by mentors at special, invitation-only trade show educational sessions using simulation or on-line webinars

In the sustainment phase, mentors would have a somewhat diminished role as learners achieve mastery in their own right; however, the mentors would occasionally resume their direct instructional role during the special, invitation-only trade show educational sessions or the on-line webinars.

As an example, once the learner has completed basic bronchoscopy training, he might be invited to participate in a webinar, followed by an advanced simulation training and opportunity to interact with faculty through advanced web and mobile tools.

## **SUMMARY**

This paper describes the effective instructional delivery methods that can be created for medical device companies using blended learning solutions, accented by simulation programs designed by Symbionix. These methods result in faster learning cycles so medical devices can be introduced much faster to the marketplace.

The methods used are motivating to the learners, cost-effective since retraining is often unnecessary, and timely since much of the programs can be delivered on an as-needed basis. Our solutions capitalize on the many experts already on staff through the Clinical Practice Communities. This community also lays the foundation for future reinforcement and support for the learners on a long-term basis.

Our state of the art simulation programs allow for timely and cost effective training without the costs and risks of actual field training that is often impossible to support. All of the instruction can be stored, evaluated and categorized using our specialized learning management system that employs a medical device based focus and is individualized for the special needs of this industry. Our interactive content is designed with high quality technology based on very detailed needs analysis in order to zero in on the needs of the specific organization.

While Symbionix can definitely provide the knowledge and tools necessary to create effective learning programs, more importantly, we support the vision of combining best in class technologies to enhance learning experiences and facilitate knowledge communities, allowing medical device companies to compete at the necessary global level needed in today's marketplace.

## **ABOUT US**

### **Simbionix**

Founded in 1997, Simbionix is the world's leading provider of simulation, training and education solutions for medical professionals and the healthcare industry.

With its full array of MIS simulators, PROcedure Rehearsal Studio for case rehearsal and planning, MentorLearn Simulator Training Management, and online Simposia Clinical Practice Communities, our company is committed to advancing clinical performance and optimizing procedural outcomes through education and collaboration.

Incorporating the physician's voice into product design and validation processes, Simbionix produces the most comprehensive, reliable and effective learning solutions for its customers.

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