Applying Instructional Systems Processes to Constructivist Learning Environments

BY BILL BRANDON

Oxy-mo-ron (n) a figure of speech in which opposite or contradictory ideas or terms are combined (Ex.: jumbo shrimp, constructivist design)

Believe me, this is an article I have approached with trepidation. There is more than a little paradox involved in the term, “constructivist design.” In my most recent articles, I’ve introduced the basic theory behind constructivism and reviewed some of the tools that learners can use to construct knowledge. The essential difference between the constructivist approach to learning and more traditional models is that in constructivism the point is not to precisely transfer knowledge from the instructor to a group of learners, but to facilitate the individual learner’s ability to build on and extend existing knowledge within a given domain. In that sense, it seems presumptuous to speak of designing constructivist e-Learning, in advance, for a mass audience.

However, because the rubber has to meet the road somewhere, pristine theory must inevitably be drawn into contact with squalid practice, and so in this article I shall show how to start designing e-Learning along constructivist lines. I’ll provide links to multiple resources, models, and discussions about this process online and elsewhere. You, Dear Reader, may then resolve the irony in this undertaking for yourself and in your own way.

Similar to traditional design of instruction in which the designer has a choice from among many step-by-step procedures for building a course, in construc-
As in any profession, there are many different perspectives about the best strategies, techniques and tools one can employ to accomplish a specific objective. This Journal will share these different perspectives and does not position any one as “the right way,” but rather we position each article as “one of the right ways” for accomplishing a goal. We assume that readers will evaluate the merits of each article and whose approaches to design are different in significant ways from Jonassen’s.

It is likely that there will never be a universal constructivist design framework such as ISD (Instructional Systems Design), Gagne’s Events of Instruction, or Dick and Carey’s model provides for the objectivist approaches. However, by paying careful attention to developments within the community of practice and to the body of work done by constructivists, designers can build up their own knowledge and toolkit of the principles that work. My purpose here is simply to open the introduction to the community of practice and to suggest places to start.

Benefits of constructivist design

One of the questions that a designer might reasonably ask is, “Why should I consider a constructivist approach to learning?” Perhaps it would be well to take a little time to give my answer to that question.

First, please be aware that I am not advocating replacing your current design model completely with constructivism. The traditional approaches to designing and delivering instruction (sometimes referred to as the “objectivist approaches”) work quite well for many learning situations, as long as they are appropriately selected and correctly applied. In some cases, either an objectivist approach or a constructivist approach would provide satisfactory results, depending on the maturity of the learners. But there are many situations you face as a designer, when you will find that you need to support learning in domains or for audiences where an attempt to transfer knowledge or skill from a subject matter expert’s head to a learner’s head is doomed to fail. Those are the times to reflect on constructivism and its many benefits, and to ask, “Should we do something different?”

It’s good to reflect that people learn all the time, every day, and that most learning takes place outside of a formal setting. People add to what they know and to what they can do, and for the most part without any “e-” being involved in the learning at all. It’s clear that the mechanisms by which these learnings take place are different from those used to teach in a traditional setting, and that the mechanisms are powerful. Much of constructivism is based on careful study of those “other” mechanisms. In many cases, information and communication technology — the Web, computers, and software — will make it possible for learners to leverage the other mechanisms in ways that are not possible even on the best day in a classroom.

Of course, part of the challenge to this day-to-day learning process is that people also get things wrong, perhaps more often than they “get it right.” They don’t know how to check what they’ve learned for validity, for exceptions, or for application guidelines. A substantial part of constructivist practice has to do with helping people learn how to learn, including how to test, verify, and validate new knowledge and skills and to increase their own autonomy.

Constructivism is concerned with engaging people in meaningful learning. While there are various details provided by constructivist theoreticians about what makes learning “meaningful,” one of the keys is that meaningful learning is also mindful learning. Ellen Langer (see the list of Resources and References at the end of this article) has introduced this term in a very specific way, drawing from the concept of mindfulness. A mindful approach, she points out, has three characteristics: the continuous creation of new categories, openness to new information, and an implicit awareness of more than one perspective.

There are many benefits of a mindful approach for psychological and physical wellbeing. The alternative, mindless approach to learning and living can trap people in old categories and in automatic behavior that operates from a single perspective and keeps a person from attending to new signals. There are significant consequences in a changing world to the choice between adopting either mindfulness or mindlessness.
James Atherton says that although constructivism has received more attention in education and the schools for the reasons just given, it is important in two additional ways to those who design for learners in other organizational settings and for “post-compulsory” education. Atherton, a Principal Lecturer in Education at De Montfort University, Bedford, in the United Kingdom, asserts that constructivism provides an excellent approach to facilitate professional development, and to deal with resistance to learning.

**Learning through reflection in professional practice**

“Continuous learning” has received much attention in the training press in the last decade, mainly in an organizational context. We understand from this attention that many businesses believe that continuous learning can bring competitive advantage in a changing world. However, Atherton points out that, in 1983, the late Donald Schön showed how continuous learning as a result of reflection on one’s actions is one of the defining characteristics of professional practice.

Schön was a professor at the Massachusetts Institute of Technology (MIT) when he wrote an important series of books around the processes and development of reflective practitioners. These works provided a close examination of what practitioners in different professions actually do, with the focus being on “an analysis of the distinctive structure of reflection-in-action.” Schön’s work quickly became influential as many educators involved in the development of professionals took it up.

A key part of Schön’s contribution was his insight that “Technical Rationality” — his term for the model of professional training that loads learners up with content while they are students, so that they can apply it when they enter practice — has never been an accurate description of how professionals “think in action,” and that this model is a poor basis for practice in a fast-changing world.

Helping learners discover how to reflect in action (both while doing something and afterward) is an important feature of constructivist practice, and one that has major applications for developing professionals.

(For more information on Donald Schön and his contributions to the theory and practice of learning, see his biography in the Encyclopaedia of Informal Education, at http://www.infed.org/thinkers/et-schon.htm.)

While professionals have an understandable interest in learning to be successful in their practice, other learners are more resistant. Atherton has some insights to offer regarding ways in which constructivism can address failure to learn.

**Dealing with resistance to learning**

Atherton contrasts “supplantive learning,” which questions current knowledge or skills and then replaces them, with “additive learning,” which simply adds new knowledge or skills to an individual’s current set. He makes the point that, when people fail to learn, the failure may be due to lack of motivation,
lack of ability, lack of aptitude, or to poor teaching. A fourth factor, which he says is often not recognized, is the psychological cost of change. This cost may come into play when an apparently competent, experienced adult is required to change or realizes that change is necessary.

Supplantive learning becomes problematic when it is forced, or if the individual has a significant emotional investment in the prior beliefs or skills. Where supplantive learning does not create problems, the learner may at least feel a bit demoralized because of a temporary loss of perceived competence. If the supplantive learning does become problematic, the demoralization intensifies, sometimes to “crisis” proportions. This combination makes it difficult to learn, and the learner may well simply go back to the old way of doing things.

Over time, the learner who does not just “give up” will become re-oriented through learning. The reorientation can be sparked in several ways. For example, there may be an external crisis that forces the change. In an extreme case, the individual may have the sense of “bottoming out,” so there is no way to go but up. Or, the learner may find himself or herself in a “facilitating environment,” where the learner is supported and safe, and where the change is not forced.

The function of learning under the constructivist model is to provide that supportive, safe, motivating environment. The designer’s job is to create such an environment.

**Guidelines for constructivist design**

If you look for a definitive flowchart that shows “how to design constructivist e-Learning,” you won’t find one. That’s because:

- Constructivism isn’t an approach to learning that can be outlined in a flowchart and applied the same way to all learning, over and over;
- Constructivism is about how individuals create meaning and knowledge, by extending and modifying current personal knowledge and skills; and
- Constructivism is not a specific approach to design — it’s a way of thinking about design.

However, you can find plenty of guidelines. These are useful because constructivist ideas can be incorporated into the typical instructional design process without impairing the project management and quality-control functions.

Brent Wilson, James Teslow, and Rionda Osman-Jouchoux provided an extensive set of ideas in their 1995 chapter on the impact of constructivism on instructional design (ID) fundamentals (again, please see the Resources and References section at the end of the article). They also gave a great summary of the theoretical background and research underpinning constructivism, and I recommend reading that summary along with my earlier articles.

Wilson, Teslow, and Osman-Jouchoux make an important observation when they say that, “Traditional ID models succeed largely because they provide for the management of a team of workers engaged in a complex project. ... management goals and design goals are often in tension with each other. For an ID model to work in the real world, it must combine these two critical functions into a workable methodology: effective, creative design on the one hand and efficient management on the other. ... the point is that we need a balanced set of safeguards and constraints that assure careful design and accountability, but which are flexible enough to allow the project to safely ‘fly’.”

**Constructivist learning environments**

I have already mentioned David Jonassen and his work with the design of Constructivist Learning Environments,
For an ID model to work in the real world, it must combine these two critical functions into a workable methodology: effective, creative design on the one hand and efficient management on the other... The point is that we need a balanced set of safeguards and constraints that assure careful design and accountability, but which are flexible enough to allow the project to safely “fly.”

— Wilson, Teslow, and Osman-Jouchoux

### SIDEBAR 1: Attributes of meaningful e-Learning

The primary goal of constructivist design is to engage learners in meaningful learning, which has five interdependent attributes. Technology — e-Learning — should support these same attributes.

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<tr>
<th>Attributes</th>
<th>Elements</th>
<th>Technology</th>
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<tr>
<td>Meaningful learning is ACTIVE</td>
<td>Learners are engaged in mindful processing of information, where they are responsible for the result. Learners manipulate objects and parameters of the environment they are working in and observe the results of their manipulations.</td>
<td>WebQuests, Office-type applications</td>
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<tr>
<td>Meaningful learning is CONSTRUCTIVE</td>
<td>Learners integrate new ideas with prior knowledge in order to make sense or meaning. Learners articulate what they have accomplished and reflect on their activity and observations: they construct increasingly complex mental models.</td>
<td>Web logs, mind maps, concept maps</td>
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<tr>
<td>Meaningful learning is INTENTIONAL</td>
<td>When learners are actively and willfully trying to achieve a cognitive goal, they think and learn more because they are fulfilling an intention. Technology should help learners articulate their learning goals, and then support them.</td>
<td>Web logs, WebQuests, concept maps, mind maps</td>
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<td>Meaningful learning is AUTHENTIC</td>
<td>Learning tasks that are situated in meaningful real-world tasks or simulated in a case-based or problem-based learning environment are better understood and more consistently transferred to new situations. Technology should support learners in solving complex and ill-structured problems as well as simple and well-structured problems.</td>
<td>Office-type applications, hypermedia</td>
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<tr>
<td>Meaningful learning is COOPERATIVE</td>
<td>Collaboration requires conversation, and technology can support this at any scale. Cooperation and collaboration are the most difficult attributes to support, especially if learning is evaluated on an individual basis.</td>
<td>Wikis, community systems, hypermedia, content maps, course maps</td>
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Based on Jonassen (2002 and 2003) and on Brandon (June 14, 2004). See references on page 7.
Coaching involves intervening at critical points in the instruction. Each intervention provides learners with encouragement, diagnosis, direction, and feedback.

Scaffolding adjusts the task for the learner, so that the task is matched to what the learner can do. Eventually all scaffolding will be removed.

**The constructivist design team and process**

Wilson, Teslow, and Osman-Jouchoux suggest that essentially the same cast of players will be involved in constructivist design as is involved in objectivist (traditional) design. In other words, subject matter experts (SME’s), designers, instructors or facilitators, and learners will all take part. The difference is that all of them are part of each step in the process. SMEs help design the learning experiences. Designers can serve as model learners and teachers. Teachers and students may help define or select content and then design their own learning experience. This mixing of roles requires care in implementation.

The actual design process, from a project management point of view, may not look so different from the steps in a traditional project. Again, Wilson, Teslow, and Osman-Jouchoux provide a breakdown that includes all the major activity steps, from needs assessment to evaluation, with specific tips for incorporating constructivist methodology and concerns in each step.

**Online resources**

Many designers may find it more useful to start their first project by looking at some of the activity types typically included in a constructivist design. Susan Colaric has created a wonderful resource that will assist in this process. Please see Sidebar 2: Susan Colaric’s Knowledge Base, below, for the details.

As you use the various resources, take a minute to read over the article by Joseph Petraglia, “The Real World on a Short Leash: The (Mis)Application of Constructivism to the Design of Educational Technology.” Petraglia teaches at the Georgia Institute of Technology, and he makes some important points about how to design problems and task environments for learners.

**Examples**

Another way in which many designers learn is to look at examples of the work of other designers. While I was unable to find any complete constructivist programs on line, I did find several articles that may be useful to you.

- Mahnaz Moallem has provided an outstanding example of the way in which his team combined elements of traditional instruction and constructivist environments in order to deal with a learning situation in which part of the answer required prescriptive solutions, and part of it required learner control of the environment. Mahnaz is Associate Professor of Instructional Technology at the University of North Carolina at Wilmington.

- Mark Guzdial, at Georgia Institute of Technology, created CaMILE (Collaborative and Multimedia Interactive Learning Environment) as a Web-based collaboration tool for use by students. Mark is also responsible for development of the Swiki, another anchored collaborative learning environment.

- Brent Wilson and May Lowry, both professors of Information and Learning Technologies, University of Colorado at

### SIDEBAR 2 Susan Colaric’s Knowledge Base

Susan Colaric, now an assistant professor at East Carolina University, created a knowledge base covering the instructional systems process, as a component of her doctoral examinations at Penn State University. This knowledge base is available on a Web site and it can be an extremely useful resource for designers who are learning about different approaches to learning. The URL for the portal to this resource is at [http://www.soe.ecu.edu/ltdi/colaric/KB/index.html](http://www.soe.ecu.edu/ltdi/colaric/KB/index.html) (verified June 26, 2004).

The knowledge base incorporates 427 files, 213 pictures, and 2088 internal hyperlinks. Among the resources that will be of interest to readers are eleven articles relating to constructivist design.

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<td>Constructivist Learning Environments (OLEs)</td>
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<td>Open Learning Environments (OLEs)</td>
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Denver, compiled a very useful set of links, including links to actual projects, in their paper “Constructivist Learning on the Web.”

Finally, the IBM Watson Research Center has published a number of papers from its Collaborative eLearning projects, and these name actual organizations involved in workplace training programs that make use of collaborative learning on the Web.

How to get started

Many designers find it easier to start adding collaborative elements one at a time to course designs, rather than to try to design a complete constructivist model all at once. I would recommend starting with a simple case-based approach in a single module. Susan Colaric’s Knowledge Base has enough information in it to make that possible.

Another way to begin would be to add a WebQuest to a synchronous eLearning program, following the guidelines on Bernie Dodge’s WebQuest page. Then have the learners work together to create their own WebQuest, based on the model you have provided. I also recommend looking over all of the Web sites mentioned here, and contacting the authors.

This summer, we will also be publishing an article on Problem-Based Learning that you will not want to miss. Problem-Based Learning is one of the most effective of the constructivist methodologies. In the meantime, good luck with your efforts! ✍️

**AUTHOR CONTACT**

Bill Brandon is the Editor of The eLearning Developers’ Journal. He has been active in the learning and development field since 1968, and created his first e-Learning applications in 1984. Bill lives near Dallas, Texas. You can reach him by email at bbrandon@elearningguild.com.

Additional information on the topics covered in this article is also listed in the Guild Resource Directory.

**RESOURCES AND REFERENCES**


Unsticking Hands-on Activities

How to think outside the monitor

Consider creating online instruction for the following purposes: transitioning from one email client to another; teaching managers to write legally defensible performance reviews; facilitating use of common project management tools. In high-quality classroom instruction, hands-on activities allow learners to practice achieving certain results. How do you do these same hands-on activities online? Think it’s hard to do? It’s time to get unstuck!

When we design instruction, we want learners to be able to do something, not just look at content or answer basic (and often not especially useful) questions about it. In a project management course, is it more important that people learn to use project management tools (Gantt charts, for example), or that they be able to recall definitions for tasks, duration, milestones, and dependencies (which they can easily look up as needed)?

Let’s look at the three proposed instructional modules for a moment and pull out a few learning outcomes we might hope to achieve. (See the table below.)

If we truly want learners to achieve these and other performance-based outcomes, we need to provide instructional activities that involve learners in using the content as it is used in real life. Answering a multiple-choice question that asks the learner to pick the menu in which the attachment options are located does not meet this test. A drag-and-drop exercise to match performance language with the correct policy, or to pair up Gantt chart column heads with the correct definitions, doesn’t go far enough either.

If these instructional situations were classroom-based, the desired outcomes would be achieved with realistic hands-on practice activities and plenty of opportunities for meaningful feedback. I have never heard a good instructor respond, “Incorrect. Try again.”

How do we DO hands-on online?

Quizzes, drag and drop, links... are those the main activities we can do in online instruction without advanced programming skills and mega bucks? No! Some folks think real hands-on activities can’t be done in online instruction, or can be done only at great expense and skill, but that kind of thinking results in anemic and ineffective online instruction. We have to be able to allow people to practice, not just think about the concepts, or what’s the use of the instruction? If we really can’t do that in online instruction, or have to spend a fortune to do it, online instruction doesn’t have much value. The truth is that it’s the thinking that’s a problem, not the online learning.

Here are two errors in thinking that result in online instruction containing few, or less meaningful, activities.

- **Error 1:** Hands-on has to cost a lot to build and requires loads of multimedia programming expertise.
- **Error 2:** If the course is online, ALL the activities must be online.

In the classroom, most hands-on activities involve practice, questions, sharing, and feedback. This can also happen in e-Learning: online, using discussion and collaboration tools, and offline, in field experiences away from the computer, or on the computer but not necessarily inside the course.

I especially appreciate the ability to create simple application simulations using a tool like RoboDemo that allows learners to try applications. Users can also open the application itself, and while inside the actual application they can use performance support tools and job aids. They can post questions for a designated expert in a discussion forum. If they get stuck they can go ask the designated advanced user down the hall. These kinds of hands-on (but not necessarily online) activities could help people learning to use the new email system.

Most critical hands-on activities can easily occur, but not necessarily online. In the case of the performance review training, why not allow learners to write a real review for a real person and have a human resources expert provide online feedback (through email or a discussion board) or in person? The same approach would likely work for project management tools training. Let learners build a Gantt chart, for instance, use it, and debrief their use with others and with content experts. These debriefings could take place online in a discussion forum or other collaborative environment, or in small group meetings.

Getting unstuck

In most cases, hands-on activities happen easily with blending. Blend what the computer does well with what the person does well. Blend performance support and real applications. Blend conceptual instruction online with real life coaching in person.
About the Guild

The eLearning Guild™ is a global Community of Practice

Through this member-driven community of designers, developers, and managers of e-Learning, the Guild provides high-quality learning opportunities, networking services, resources, and publications.

Guild members represent a diverse group of instructional designers, content developers, web developers, project managers, contractors, consultants, managers and directors of training and learning services – all of whom share a common interest in e-Learning design, development, and management. Members work for organizations in the corporate, government, academic, and K-12 sectors. They also are employees of e-Learning product and service providers, consultants, students, and self-employed professionals.

The more than 12,500 members of this growing, worldwide community look to the Guild for timely, relevant, and objective information about e-Learning to increase their knowledge, improve their professional skills, and expand their personal networks.

Resource Directory
The Guild hosts the e-Learning industry’s most comprehensive resource management system that includes more than 4,500 (and growing) e-Learning related resources in a searchable database. Guild Members can post resources and can update them at any time.

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The Journal provides in-depth articles about how e-Learning professionals can make e-Learning more successful in their organizations. It’s a weekly online publication in PDF format and Guild Members have unlimited access to the searchable archive of every issue published.

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The Guild Job Board should be your first stop for solving employment related issues. Whether you are an employer looking to fill a key position or an e-Learning professional looking for a new job, you’ll find success here.

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The Info Exchange enables members to ask questions of, and get feedback from, other members around the world in a discussion board format.

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Guild Members receive a 20% discount on all optional services offered by The eLearning Guild that are not included in your membership. These services include all face-to-face and online events produced by the Guild, special publications, and other services as they are developed.

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If you attend a Guild event, you have immediate access to all event proceedings. If you do not attend, as a Guild Member you still have access to the proceedings 90 days after an event ends.

Guild e-Clips
A Guild Members-only publication sent by email every week. It’s short, easy to read, and includes “clips” designed to keep members connected to the latest information about Guild publications, surveys & studies, and learning events.

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In order to maintain a vital community and provide relevant information, The eLearning Guild seeks the active involvement of all Guild Members and Guild Associates. Consider these ways to engage:

Speak at Guild Events: Members and Associates are encouraged to submit presentation proposals for any and all Guild events.

Write for the Journal: The eLearning Developers’ Journal articles are written by industry leaders and practitioners just like you who are working in this field every day.

Join the Program Advisory Committee: This committee works to craft the program content of all events produced by the Guild.

Join the Research Advisory Committee: This committee works to identify the topics for Guild surveys and studies, and also develops the survey instruments.

The eLearning Guild organizes a variety of industry events focused on participant learning:
3. Constructivist Learning Environment. Constructivism provides both theoretical foundation and practical opportunity to move towards building constructivist learning environments. A constructivist learning environment (CLE) is a technology-rich, open environment. This study compared the effects of a constructivist-visual mind map teaching approach (CMA) and of a traditional teaching approach (TTA) on (a) the quality and richness of students' knowledge structures and (b) TTA and CMA students' perceptions of the extent that a constructivist learning environment (CLE) was created in their classes. Constructivism is a learning theory found in psychology which explains how people might acquire knowledge and learn. It therefore has direct application to education. The theory suggests that humans construct knowledge and meaning from their experiences. Constructivism is not a specific pedagogy. Piaget's theory of Constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements. Research support for constructivist teaching techniques has been mixed, with some research supporting these techniques. Applying Constructivism: A Test for the Learner-as-Scientist. Constructivist learning theory predicts that knowledge encoded from data by learners themselves will be more flexible, transferable, and useful than knowledge encoded for them by experts and transmitted to them by an instructor or other delivery agent. If this prediction is correct, then learners should be modeled as scientists and use the reasoning and technologies of scientists to construct their own knowledge. However, it cannot be taken for granted that the prediction is correct, or correct in every knowledge domain. A constructivist model of learning has been proposed as an alternative to the transmission model implicit in most behaviorist and some cognitive approaches (Brown, Collins, & Duguid, 1989).