Redesigning Learning Design

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Introduction
When it comes to the large body of existing learning technology solutions, one common phrase captures the outcome: “#fail”. There are failures in objectives, in execution, and in evaluation. We fail for lots of reasons, but the outcome is unacceptable, regardless. We need to identify what and how to do better.

The source of the problems is in our architecture, cognitive and social, that introduces systematic errors into our design processes, in general. This holds no less true for learning design specifically, though we also encounter unique problems. The question is, what can we do about it?

I hold our design processes are broken and that we can refine them to be better. We need to look at our limitations as designers, and the structure of the design process, and identify flaws and potential improvements. We need to review the designer and the designing, and redesign the design process.

Good Learning
To understand what we need to design to, and where we go wrong, it helps to briefly review what constitutes good learning design. In short, good learning is oriented towards giving the ability for learners to do new things that they can’t do now.

It starts with meaningful objectives. We need objectives that are focused on new abilities, not just knowledge. We need to state the desired behavior clearly and concisely, and then develop learners until they can achieve those objectives. Our goals should be three-fold: retention over time until needed, transfer to all appropriate (and no inappropriate) situations, and confidence in the ability to perform.

To develop these abilities, we need learners to practice sufficiently. Ultimately, learners should be able to perform full tasks, but initially they will need support. We should provide scaffolded practice that gets learners from where they begin to where they need to be. That practice should be contextualized, appropriately challenging, providing appropriate feedback, and more.

To guide performance, learners need rich conceptual models that support their ability to interpret appropriate action (Bransford, Brown, & Cocking, 2000). These models will provide guidance for decisions in the practice environment. Composed of conceptual relationships that reflect how the world works in this domain, these models support explanation of results and prediction of appropriate action.
To help learners understand how the concepts guide performance, learners will need examples of those concepts in context, positive and negative, to understand the nuances. Like practice, these examples will gradually increase in complexity. Some, particularly in grey areas, will likely not have a ‘correct’ answer but spark debate between learners that will raise relevant issues.

This benefit of constructive interaction suggests that learning together – social learning – is more powerful as well. Ideally, learners have a chance to learn together, to share different viewpoints and negotiate a shared understanding. Such interaction, appropriately guided, provides the optimal opportunity to converge on a rich and robust appreciation of the concepts and their application.

Good learning includes addressing the emotional or affective side as well as the cognitive. More accurately, we need to address the conative domain (Snow, 1989), learner’s intentions to learn, their motivation, anxieties, and confidence. We need to open up learners to why this is important to them before we can expect our interventions to have an effect. We need to introduce the material, choose relevant problems to solve and examples, we need to concern ourselves with maintaining their attention, and to recognize their effort.

Good learning also addresses the meta-cognitive aspects of learning, helping learners develop their information gathering, problem-solving, and strategic skills. These have to play out on top of meaningful activity, but need to be explicitly developed, not assumed. Ideally, we shift responsibility to learners to develop their own abilities.

Additionally, we need to be very careful in our use of media. We must not add in extraneous materials, but instead must focus on enhancing without overwhelming.

Aligning these elements is doable, but not trivial. And there are ways we can reliably go awry.

**Flaws**

When we look into the sources of potential problems, two major strands stick out. From a cognitive perspective, we can look at the limitations of our brains, and the consequent outcomes on our designs. When we look at the process of design, with the different roles played and the pressures and barriers designers face, we unearth different sources of problems.

**Brain Models**

Our brain models evolved from philosophical, through behavioral, to cognitive. Along the way, we very much viewed ourselves as rational beings with all the thought being in the head. The empirical evidence began to show, however, that our brains operated less reliably than formal logic, and more powerfully.

More recent models of cognition (e.g. Clark, 1996) have begun to recognize a more situated cognition, whereby our cognition is largely reconstituted on the fly, distributed across others and elements in the world as well as in our head. Also, our processing is largely compiled away and operates automatically, and our conscious problem solving is effortful and prone to systematic biases (See Figure 1). Overall, the patterns we observe are emergent, but there are reliable outcomes.
Figure 1. Our cognitive system

Much of our processing is done via our long-term memory from well-determined patterns that are inaccessible to conscious inspection. Most of the time this is good, but it can lead to some systematic errors. The more conscious problem solving requires considerable mental energy, and has separate barriers such as limitations to working memory. Often, we seduce ourselves that we have made a conscious decision when instead our conscious processing is only creating a rationale for what our subconscious has decided for us.

As a result, there are some reliable flaws in our execution, in that we have some systematic patterns of less than optimal performance. These include patterns like functional fixedness, set effects, premature evaluation, and brainstorming limits (e.g. Anderson, 1985).

Functional fixedness is where we use a tool in certain limited ways. So, for instance, we will see a screwdriver as a tool for turning fasteners, and perhaps can miss the opportunity to use it as a weight, prying tool, or other capabilities afforded by the form of the tool. So we might use a rapid eLearning tool for standard ‘page-turning’ content, even though it could support branching scenarios.

This is related to another phenomena, set effects. Set effects are seen when we have solved a series of problems with a particular approach, and then are more likely to solve a similar problem with the same approach, even if there’s a more efficient approach. For example, we might use eLearning rather than a job aid, because that’s what we’ve used in other situations.

Premature evaluation is the problem of reining in potential solutions prematurely by evaluating them too soon. The proper process is to hold off evaluation of solutions until a very deliberate divergence occurs first, and once it is determined that sufficient divergence has occurred,
convergence can occur. Evaluation starts the convergence process, because an evaluation can be used to weed out less desirable alternatives.

Brainstorming has recently come under attack too. It seems that in at least one manifestation, where the team is brought together before the problem is introduced, the outcomes are far from optimal. The problem is that the first thought expressed after the problem statement tends to constrain the creativity of the rest of the team members, constraining divergence similar to premature evaluation.

These aren’t the only sources of potential disruptions to the design process, however.

**Roles & Responsibilities**

The design process is essentially never a single person process. There are numerous roles involved, and each of these roles brings it’s own benefits and it’s own barriers to successful design. We’ll use a representative representation of the process to talk in generalities (see Figure 2).

![Figure 2. Typical Design Roles and Responsibilities](image)

Typically, someone ‘owns’ the need for the learning design, and is by definition the client for the learning design process. It can be a business unit that needs sales training, or an instructor wanting to enhance their class. They’ll contract the work, implicitly or explicitly, with a vendor
who can be internal like the manager of the learning and development (L&D) unit, or an external solutions provider. The vendor will often have a project manager who oversees the work of the designer and talent (media experts for the various elements used in the solution, such as graphic design) as well as development. The client will typically provide expertise, whether a subject matter expert (SME) or a series of resource materials, that the designer will use as a basis upon which to design. The resulting design is developed, sometimes by the designer using rapid tools and sometimes by a separate development team. The resulting content is hosted on a system and interacted with by a learner in a classical version.

In practice these roles can vary widely. For example, the designer may also be vendor, talent, project management, and developer all-in-one in one-person shops, or conversely there may be multiple designers, talent, or developers.

These roles and exchanges often lead to further barriers in the design process. There are barriers with clients, SMEs, talent, and developers as well as the designer barriers identified previously.

Clients often are not aware of the criteria of good learning design. Hearing them resist changes that will improve learning, and retort “just do that thing you do”, is not unknown. They also demonstrably purchase solutions that are well produced, but not well designed. Lack of awareness of what constitutes good design and trusting vendors to understand deep learning leads to the glut of page-turning eLearning content.

Clients may also avoid evaluating products. They may develop or purchase them and assume they’re sufficient. Vendors contribute by assuring customers that the methods are sound and the output consequently also. In some instances, organizations don’t care (e.g. compliance training), but other circumstances may also provide such behavior. The end result can be surprise when content is avoided, or the empirical ‘dropout’ rate seen with much eLearning (e.g. Parker, 1999).

SMEs, because expertise is inaccessible to conscious inspection, cannot accurately describe what they do (Clark & Estes, 1996). They either resort to stories about what they do with little correlation to reality, or to reciting the knowledge they learned (which they do recall). And an unaware instructional designer can dutifully record the knowledge needed and ensure that the learning experience covers that knowledge, or focus on inaccurate assessments, without actually obtaining meaningful objectives to begin with.

Designers (and developers) also often work alone, and consequently can be blind to either particular mistakes or systematic errors in their approach. Individuals typically have consistent errors that are easy to track and remediate if the effort is made, but working alone under deadlines can remove opportunities to review one’s own work, let alone have peer evaluation.

The deadlines are a factor of the realities of meeting the project constraints. Project managers are responsible for keeping track of the holy trinity of scope, schedule, and resources (read: budget). These are important, but often project managers aren’t aware of tradeoffs in design. They may err on the side of high production values to impress clients and underemphasize the quality of the actual learning design. It’s not clear where the onus lies on this mismatch, but it’s a common problem.

Similarly, it appears that media folks can over-produce as well: text is reliably overwritten, graphic look and feel can emphasize high resolution over relevancy, video can be overly flashy.
And other media are arguably underused: for instance graphic novel formats have many benefits for learning: story, cognitive annotation through thought bubbles, low bandwidth, easy globalization and localization, high cultural relevance, de-emphasis of unnecessary contextualization, and more. You want to balance media with their cognitive function, but that means a holistic integration that doesn’t always happen.

Development has opportunities for flaws as well. Particularly for complex interactions such as games, it’s easy to use an experienced animator who doesn’t understand software engineering principles. Particularly for self-taught users of interactive tools, the knowledge to use things like constants and commenting are not fully understood. As a consequence, the subsequent necessary tuning required to turn a program into a game introduces more problems.

Which brings up a final flaw, lack of evaluation. Too often, instructional design can take a waterfall approach that says “if we design it according to principle, it will be good”. Learning technology design needs evaluation for usability then educational effectiveness. Ideally, particularly in the form of games, engagement should also be evaluated, yet this rarely happens.

**Inputs**

So where can we look for input? How have other fields addressed these potential problems? Design covers a remarkably large number of fields, including software, interfaces, products, buildings, graphic communication, and more. While we can proceed from first principles, it is provident to see what other solutions have emerged in other disciplines, at least an examination. Then we can look at what efforts have already been taken within the field.

**External**

One of the closest areas to learning technology design is interface design (e.g. Preece, Rogers, Sharp, Benyon, Holland, & Carey, 1994). Here the outcomes are systems designed to match the way people think, not how they learn, but there are similarities. One of the most important aspects that the usability field developed early on was the notion of iterative design with formative and situated evaluation, reflecting the uncertainties inherent in designing for humans. A strong emphasis is placed on real user involvement, not only in testing but even in the design process. Other innovations include ‘discount usability’, doing the research to identify what the least amount of evaluation is that can achieve the necessary goals. Anecdotally, an intriguing approach came from a usability-consulting firm that used two separate product teams for engagements who each came up with their own design.

Industrial design is another area that has had considerable input. Perhaps best known is Norman’s work suggesting matching tools to the way we think about the world (1990; 1993). While primarily focused on interface design, it also looks at more physical input devices. The principles of affordances, forcing functions, mapping, and more provide strong guidance for assisting human cognition to perform.

Software engineering is an area where considerable effort has gone into minimizing flaws as errors can have substantial consequences. The Personal Software Process/Team Software Process (Humphrey, 2002) has individuals document their estimates and subsequent time to
develop, and also posits peer review. Agile methodologies pair up peers for development, as well as having strictures about the size of iterations and a strong focus on testing measures.

The ‘arts’ have often employed a studio approach, where the work is visible to others. Here folks work in a way that others can observe, comment, copy, and even collaborate. Another approach that studios of various sorts have developed are effective brainstorming techniques, involving separate individual work prior to coming together to work collaboratively, continuing to diverge before converging.

Atul Gawande (2010) documents the ways in which a number of fields including medicine, architecture, and flight, use checklists to minimize human error. These tools, honed through iterative testing, are excellent examples of using simple technology to complement our mental capabilities. Gawande finds such tools to address both the things we miss, and the times we need to synchronize teams.

Game designers, tasked with creating engaging experiences with big budgets and teams have had to find ways to make design work. In addition to working hard to understand the emotional side of the equation, they have detailed documentation of the design as a living document, and regularly develop prototypes and interim deliverables to communicate. Iteration is heavy, with as much as 90% of the effort being placed on tuning and refining the game to achieve commercial levels of experience.

Internal

The learning technology design field has made it’s own efforts to avoid certain traps. These include design processes and approaches, as well as heuristic support.

The most well-known design process is ADDIE, the acronym for steps of Analysis, Design, Development, Implementation, and Evaluation (Molenda, 2003). Initially, this process was typically used in a waterfall approach, with one stage moving steadily into the next in one pass, but has more recently been revised to be iterative. Regardless, the process has increasingly been criticized for not being flexible enough.

As a result, various other processes have been proposed, from adopting the agile methodologies of software engineering to replacements for ADDIE. The Successive Approximation Method (Allen, 2012) is one such replacement, having staged phases with limited numbers of cycles. Another approach is Merrill’s Pebble in the Pond (2002) that focuses on the problem to be solved and then iterates to get there.

Other approaches have included design systems that scaffold the design process. GUIDE is one example of such a system (e.g. McNelly, Arthur, Bennet, & Gettman, 1996), and others have included proprietary systems used by major content publishers. The point is to scaffold selections, so earlier decisions constrain later ones, and to provide support for documenting the result. While structured, such rigorous support can also be constraining.

One of the limitations of instructional design approaches is that they assume courses as the solution. The Human Performance Technology (HPT; Stolovitch & Keeps, 1999) approach was designed to look at the performance gap and identify different potential causes and devise
solutions matched to the problem. Courses are only one solution, while job aids or incentive adjustment are other tools available to address needs.

Electronic Performance Support Systems (EPSS; Gery, 1995) are another approach that could address situations where courses would not address the root cause. As an interesting aside, the promise of EPSS included that not only could they assist the performer in the moment, but develop them over time. However, this approach has as yet not been demonstrated.

Another gap is in emotional engagement. Keller (1983) has addressed this in his ARCS model (Attention, Relevance, Confidence, and Satisfaction), with insufficient impact on design. Another approach was Engaging Learning (Quinn, 2005), written to propose a solution to systematically including emotions in the learning experience design process.

What we see are individual efforts that address some of the problems but not a systematic approach to incorporating all of the necessary elements. We have an opportunity, and a need.

**Implications**

On principle, we need to start with the source of the problem, as HPT would suggest. However, we can and should go further. We should look at the performer and the resources as a system, and determine what should be developed in the performer, and what should be resources to augment the performance. Then we can work backwards to develop any required learner interventions, and required resources.

What I start with is a different design model, which implies some design processes, but doesn’t directly address the design process flaws identified earlier. This creates a forcing function for making the right considerations, after which we can consider some process revisions.

**Performance Design**

I term this approach *Performance Design*, to recognize that we’re not talking about learning but instead are addressing the ultimate goal of performance outcome. Even if we’re talking about formal education, we should increasingly recognize that learners will be augmented, and design our learning experiences accordingly.

What we need as a first step is to design backwards from the performance to determine what should be in the performer’s head (or performers’ heads), and what part of the problem-solving system should be in the world. Then we can design forward as second steps to the resulting learning experience and resources for performance. The resource(s) produced will need to be accounted for in the learning experience design, to be used in the learning experience as well as the performance situation (see Figure 3).
Performance Resource Design

To precede the learning experience design, there has to be an initial and associated Performance Resource Design. This is not yet fleshed out, but a variety of guidance exists. HPT, as mentioned, looks to other types of solutions such as job aids. However, elements of interactive design, and social resources also need to be considered.

Within the creation of information resources, information mapping (Horn, 1990) serves as a possible guide. Similarly, for interactive design, the field of usability provides a solid foundation. Increasingly we face a diverse technology environment as well, and mobile learning (Quinn, 2011) may be part of the solution as well.

Two bigger issues emerge. One is the overarching issue of what should be physically in the world and what should be technology-delivered. Not all resources need to be digital, as signage and tools of various sorts can still be useful and relevant.

A second consideration is what might be not in the performer’s head or the world, but in other performer’s heads. When should individuals call on the support of others? Preliminary indications would suggest that when the information is volatile or the situation is relatively unique, connecting to an expert might be more expeditious than trying to create a resource.

Learning Experience Design

Conceptually, we should think about learning experience design, starting with the decisions learners need to be able to make, and addressing a cognitive and emotional development of those skills. We should think of a trajectory that starts where the learners begin, and scaffolds them through a series of activities that develops their abilities. We should also deliberately reduce anxiety to an optimal level (the U-shaped curve of performance; Yerkes & Dodson, 1908),
access intrinsic motivation (Malone, 1981), and focus on developing confidence as well as ensuring retention and transfer.

On principle, we need to stop thinking about the curriculum for learning being content, but instead need to start thinking about a series of experiences constituting the focus of curricular design. Activities as broad as interviewing someone, playing with a simulation, performing, or doing an internship are as critical as reading a book or taking a test. Problem-based learning (Barrows, 1986) is one instance of this sort of approach, but a broader picture can look at a variety of experiences and activities that could constitute a competency path. An activity-centered design drives the learners to the content once meaningfulness is established. The activity should lead to outputs, around which reflection as a rationale for the design of the outputs or reflection on an experience serves as a basis for mentors to examine the underlying thinking (see Figure 4).

![Figure 4. Activity-Centered Learning](image)

With this model, we have concrete outputs of products and reflections to serve as a basis for evaluation and mentoring. Digital technologies used to enable activities can also leave tracks of learner behaviors that can serve as mentoring opportunities. We can use tools to conduct activities, to produce output products or reflections, as well as access content. We can layer on 21st century skills around solving problems, developing products and rationales.

To elaborate slightly, it should be clear that activities can be embedded in other activities (see Figure 5). So, an overall activity to develop a project might include sub-steps of submitting a prototype, a prototype evaluation, and a redesign. This also includes sufficient activity,
sufficient practice, to develop a skill to where learners can’t get it wrong, instead of until they just get it right.

Figure 6. Activity embedding

Another elaboration is to recognize that activities can, but do not have to, be individual. Activities can be assigned to groups, or learners might develop aspects of a larger project individually, and then combine and refine their individual contributions (see Figure 7). The power of social learning should strategically and systematically be leveraged.

Figure 7. Social Activity

The next level is to gradually hand off the responsibility for choice of activity, content, and product to the learners (see Figure 8), within initial scaffolding and gradual release. Here, learners are learning to become self-improving learners. Some of the activities can also be reviewing other learner’s products and reflections, to internalize self-monitoring. This brings in the meta-learning, learning-to-learn elements.
An additional layer is to have the rationale for the curricular design made available (see Figure 9). This additional layer makes the learning design explicit, the pedagogy and the objectives, supporting learners taking over responsibility for their own learning. This enculturation into the culture of learning design in the domain of learning is an important part of ‘becoming’, not just doing (Axelsson, Dahlgren, & Dahlgren, 2010).

Together, this approach to learning experience design develops not only learner ability in the domain, but develops them as members of a community as well. Further, and deliberately, it makes it difficult to consider knowledge acquisition and recitation as a learning experience.
Design Process

In addition to the design considerations above, we need to ensure our design processes are sufficiently rigorous to deliver against the design model promise. We need, in executing against both learning experience and performance resource design, to ensure that we capitalize on our strengths as design teams, and provide support to work around our weaknesses.

It’s clear that a starting point is having meaningful goals, a clear understanding of the steps along the way, and support for checking against a set of necessary components. A second component is to have teams bringing in complementary strengths, using properly structured brainstorming and peer review. Finally, we need to ensure that we develop initially, and subsequently test against clear goals. Another principle would be to support ‘thinking out loud’, so that the underlying thought processes behind designs decisions are scrubtable.

A set of heuristics proposed earlier (Quinn, 1995) delineated elements that are reflected in many of the methods identified above, namely working in teams, without ego, taking analytical steps of imagining no limits and a very eclectic approach to information gathering, using appropriate brainstorming, iterative and formative design, low-tech prototyping, and looking beyond one solution. We need to incorporate these elements into a design process. Fortunately, it looks like SAM (Allen, 2012) can potentially serve as a viable starting point. There’s more work to be done.

Conclusion

While preliminary, the structure here provides a framework to think forward about redesigning both workplace and classroom learning, and arguably break down the barriers between the two. There are a number of further steps that need to be addressed.

While the activity-centered learning framework provides support for rethinking learning design, it is not yet specific enough. While Allen’s (2012) SAM may be a component, there could need to be more in terms of choosing activities that address the emotional trajectory as well as the cognitive.

The performance resource design is clearly embryonic, and needs considerable work to integrate technology and people resources. Further consideration for distribution across different platforms in effective ways is potentially within the scope of design as well.

Another factor is the relative cost of resources. In the case of performance resource design, there may be situations when people resources are essentially unviable by reason of expense, and other circumstances when support is more effectively or efficiently delivered by social resources.

Finally, this discussion is largely predicated on our ability to anticipate the performance situation. Increasingly, it is plausible that conditions will be more ambiguous and chaotic. Our solutions increasingly will need to develop resilient and resourceful performers rather than a fixed solution. Our learning designs will need to reflect and support this reality.
We need to revise our approach to learning design. This proposal attempts to integrate a disparate suite of opportunities and constraints into a coherent whole. There is further development needed, as well as empirical validation.

References


