Instructional Strategies for the Future

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As education and training opportunities become ever more available—on demand, anywhere, anytime, and across our lifespans—individuals increasingly experience bursts and waves of disconnected, transitory, and episodic learning. Hence, it's our challenge, as learning science practitioners, to help learners filter data noise, focus on relevant information, and meaningfully connect new learning to past experiences. Towards that end, this chapter provides a framework that illustrates a shift in thinking about instructional strategies, refocusing these principles to better support the future learning ecosystem and foster connections across learners' lived experiences. Building on traditional instructional strategies shown to be effective in formal learning contexts, we propose new approaches that cut across individuals' learning episodes, potential careers, and lifespans.

Background

For decades, the design of instructional strategies (and learning systems, in general) has been largely treated as a micro-level, reductionistic, and linear activity—focused on analyzing particular learning outcomes, aligning them with suggested instructional strategies, and then delivering instruction in straightforward ways to elicit desired responses. However, today, learning occurs in a multidimensional frame, blending formal, nonformal, and informal experiences that transcend time, space, medium, and format. The complexity of our lives and diversity of available technologies warrant a shift in learning theory, away from standalone learning episodes that push information in a singular manner and towards a multipoint, multimodal view where learning crosses the boundaries of time, context, delivery methods, and devices.

Although networked technologies have already made it possible to support ubiquitous lifelong learning, our teaching methods and instructional strategies haven't caught up with these new learning affordances. We're still designing at the module, course, or program-level, ignoring broader learning pathways, and discounting the additive peripheral events learners encounter throughout their lives. We need to modernize our conceptualization of "instructional strategies," and expand these principles to support a more open, flexible, and personalized learning ecosystem. We need to create continuous and meaningful lifelong learning and find ways to incorporate elements from diverse and informal contexts into it.

Fostering more cohesive, coherent learning will likely involve designing some manner of "macro-level instructional arcs" that span a mosaic of individual and collaborative learning experiences—meaningfully intersecting different events across a lifetime. It will also require us to make better use of multimodal communication tools to help individuals curate information and generate knowledge across experiences. This position reflects the connectivist view of learning, which perceives knowledge as a network, influenced and aided by socialization and technology (Siemens, 2006). From this standpoint, knowledge isn't only contained within an individual or information artifact; it's also distributed externally through networks of internet technologies and communities, accessible via social-communication tools. Learning takes place in these autonomous, diverse, open, interactive, collaborative, and global knowledge systems. Hence, recognizing relevant information patterns, constructing new connections, and nurturing and maintaining connections become critical skills for achievement. Individual learning opportunities can be (and have been) designed with this paradigm in mind; the full solution, however, requires even more (Del Moral-Pérez et al., 2013; Siemens, 2006, 2008).

Limits of Conventional Instructional Design

Traditionally, an instructional designer begins with some given set of criteria such as the lesson's purpose and subject matter, learners' general characteristics, and likely some logistical constraints. From these, designers extrapolate the type (e.g., psychomotor, cognitive, affective) and level of learning outcomes (e.g., remembering and understanding, applying and understanding), objectives of the associated assessments (e.g., formative, summative), and other delivery factors (e.g., course schedule, perhaps). They break the goals into objectives, the objectives into tasks, and then select some set of instructional interventions to help learners master each component. They continue working in this linear fashion—breaking down the plans into smaller and smaller parts, and carefully considering the content, delivery, and learner activities for each. This is known as "backwards design" (Wiggins & McTighe, 1998).

The traditional approach to designing instruction generally assumes a given target—a particular individual or cohort—as well as a specific setting and general set of conditions. It focuses on determining the appropriate configuration of instructional interventions in insular and finite curricular units, such as a course or training program. However, as we envision learning across lifetimes, this model no longer suffices. In the future, we need instructional design that encompasses diverse learning experiences, media, populations, and contexts—many of which will fall outside the instructional designer's purview. In other words, we need an updated approach that

- Facilitates learning as a gestalt, derived from the collective sum of all learning events and experiences;
- Recognizes learning outcomes are increasingly self-directed and stitched across different contexts, networks, and communities; and
- Actively incorporates technology to enable learning—not only as an instructional delivery mechanism but also as the "glue" to connect learning events to one another.

Consequently, we need a multidimensional model of instructional design that integrates traditional micro-level interventions as well as macro-level principles, that considers not only instructor interventions but also learners' own agency, and that actively connects experiences across the crisscrossing landscape of learning.

Strategies and Tactics; Instruction and Learning

Instructional design terminology is used in a hodgepodge of ways (Akdeniz, 2016). We won't attempt to unkink it, but it's useful to highlight several terms. First, consider "instructional strategies" (also frequently called "teaching strategies"). This is the most common way to refer to the instructional interventions used by teachers, trainers, and instructional designers. In more careful discussions, this concept is typically divided into "instructional organizers," at a more global level, and "instructional tactics" at a more granular one (Jonassen et al., 1990). Exactly where the lines are drawn between these levels is a bit fuzzy—and largely irrelevant to our discussion. What's more applicable is the general idea that there are instructional design distinctions at different conceptual and granular levels.

The second important distinction comes in comparing *instructional strategies* to *learning strategies*. Where instructional strategies are devised and applied by learning experts to some planned block of instruction, learning strategies are personal methods used to improve one's own knowledge, skills, and experiences across the range of formal and informal learning. In theory, learning strategies and instructional strategies mirror each other. For example, an instructor might design a lecture, provide some illustrative examples, and give feedback. Meanwhile, a learner may work to memorize terms, mentally compare-and-contrast new ideas to prior knowledge, and reflect on performance.

In many ways, the distinction between instructional strategies and learning strategies is a question of *control*. As discussed in the previous chapter, transactional control (or the extent to which the learner makes decisions versus some external authority, such as the instructor or software) is an important factor. As one might expect, control of learning can be handled in different ways: internally by the learner, externally by some structure or authority, or insufficiently, without effective support from either internal or external sources.

Also, as Jon Dron's transitional control theory emphasizes, some form of negotiated control, in the middle of internal–external control continuum, is best (Dron, 2007a, 2007b). Hence, the notable concept here is not only the contrast of instructional strategies to learning strategies, but also the potential for their integration—that is, blending learner-directed and authority-directed strategies together.

One final distinction for the future learning ecosystem is belied by its name. Why is it an *ecosystem*; why not just a regular, old *system*? An ecosystem, by definition, is comprised of interconnected parts, with the behaviors of many individual agents affecting one another as well as the environment's overall holistic pattern. It's a dynamic system, in the engineering sense, involving many dispersed, interdependent, interacting elements, and, notably, it's not guided by some top-down, centralized control. Some portions may be structured and designed, while others act or interact with their own agency. Consequently, for our learning ecosystem, how we understand instructional structure and learning is an essential consideration.

The Expanding Context of Future Learning

To advance instructional theory, it's necessary to expand its design towards a modern, longitudinal view of learning, one that facilitates connectivist principles and seeks to amplify outcomes throughout an array of teaching and learning situations, across multiple contexts, diverse learning objectives, and disparate learning modalities. This section outlines eight principles likely to shape the purpose and application of instructional strategies in this complex future context.

1. Connect diverse learning experiences. Explicit in the "ecosystem" concept are the notions of *diversity* and *interconnectivity*. Most relevant, here, are the diversity of learning experiences and their complex interconnectivity with one other. As humans, all of our experiences naturally affect one another. The question is not simply "how to ensure learning episodes are somehow additive," but rather how to intentionally build meaningful and effective connections among learning episodes that advance overall learning goals. Even within a relatively constrained setting, like a single course, instructors and instructional designers need to broadly consider multiple and varied learning modes and, importantly, how to help connect learners' experiences across them. As a simple example, consider a semester-long

class that incorporates face-to-face seminars, online courseware, an additional smartphone app used to remediate some students, and informal resources, such as videos or blogs that students find online. Courses that blended these sorts of resources are already common. Part of the challenge, however, is gracefully navigating the available set of learning-resource options and *intentionally* integrating them so that they not only coexist but also correlate.

This mosaic of learning components, of course, is often more complex than this example describes. In reality, learning experiences span multiple formal and informal events, timespans, and contexts, contributing to an ever-evolving trajectory of reconfigured and connected experiences, through the lifespan, across multiple contexts, and intersecting with varying developmental dimensions (such as psychomotor, social, emotional, and cognitive learning). An ongoing challenge for learning professionals, then, will be to help learners integrate these myriad experiences in thoughtful ways.

2. Connect to, and enable outside connections from, learning opportunities beyond the planned instruction. The preceding example described the integration of learning resources around a central unifying core (a single course). This is good, but we need to think even broader. In addition to the planned activities designed in or around a particular formal learning event, learning professionals need to consider the impact of learning activities that take place outside of their direct control or even full awareness, such as independent self-directed learning, informal experiences, and other external formal activities (such as courses taught by other teachers on different subjects). Too often, teachers and trainers focus solely on the activities taking place within their purview, that is, within their formal learning episode. This may cause those learning professionals to inadvertently overlook individuals' prior experiences, concurrent learning activities, or the future learning events they might encounter. Linking to prior or external learning isn't new guidance, but the growing availability of well-designed informal learning resources combined with interconnected technologies and interoperable data make these linkages more achievable and more necessary.

For the future, it's important to consider instructional strategies that tie-in to these other learning activities *and* also to create "hooks" in the formal learning materials we create, so that learners or other learning professionals can better link our work into their own learning environments.

3. Connect learning across levels of abstraction. When a child learns to read, we first start by teaching sounds and letters; once these are learned, we teach words, sentences, punctuation, grammar rules, comprehension, and eventually one day maybe professional investigative journalism or creative screenwriting. The point is that different capabilities emerge from the integration of competencies at a given level of analysis. The "levels of analysis" concept describes the level of abstraction at which something is affected or evaluated, with the implication that the elements at each level relate to one another. Computational neuroscience David Marr has gone so far as to say:

> "Almost never can a complex system of any kind be understood as a simple extrapolation from the properties of its elementary components…If one hopes to achieve a full understanding of a system…then one must be prepared to contemplate different levels of description that are linked, at least in principle, into a cohesive whole, even if linking the levels in complete detail is impractical." (Marr, 1982, p. 19–20)

In the learning domain, considering learning at different abstraction levels helps us plan the immediate activities (level interventions), broader but still bounded experiences (macro-level interventions), and expansive lifelong learning arcs (meta-level interventions). As indicated in the earlier "Strategies and Tactics; Instruction and Learning" section, precisely distinguishing where one level ends and another begins is less important than the general concept. That concept is that we need to consider is how to better combine the micro- and macro-level approaches to designing instruction (the typical instructional tactics and strategies experienced designers already use) along with new macro-level strategies to create a multidimensional, multilayered model that helps learners aggregate and make sense of learning experiences across devices, modalities, episodes, and learning dimensions. The idea is to support learners beyond the context of a given course or training event, to help them integrate these into a more holistic course of study. For instance, a university mentor might help a graduate student understand how the different courses, job-study projects, and internships coalesce—creating integrated meaning beyond their individual parts. How do we provide similar support, but more broadly and outside of a narrow academic context? How do we help people extrapolate meaning across otherwise unconnected activities and integrate experiences in ways that expand those activities' individual values? And how do we do this across longitudinal periods—not only during a semester or academic program, but at a lifelong learning scale?

4. Consider the "in between" learning spaces. This multilayered model of learning might appear to simply connect pinpoints of learning across time, space, and modality—like a pointillist painting that reveals an image from separate daubs of paint. But the concept goes beyond that. Unlike paint blotches, which are individually contained and otherwise inert, each learning experience is dynamic and complex. Further, the "space" between learning experiences—that is, the new value derived from merging or reconceptualizing learning "frames" in response to their integration or comparison—differs from the largely additive emergent qualities of a Georges Seurat masterpiece. In other words, the challenge for learning professionals is this: How do we capitalize on the abundance and diversity of learning experiences in creative and deeply meaningful ways? Can we do more, for instance, than simply reminding students of prior knowledge or asking working professionals to consider how new concepts fit into their jobs? Can we build something more than the sum of the learning parts?

Some "levels of analysis" hierarchies include a middle or *meso* level to refer to the connections between the other levels. We're modifying this concept slightly and using the term *meso-level* to refer specifically to those interventions aimed not merely at linking across experiences but also producing unique added value from the correlations. This involves more than just linking across time horizons or subject matters, although those are both relevant. It also involves aggregating concepts at a given level so that new and integrated capabilities emerge.

5. Help learners filter overload. As discussed in Chapter 4, cognitive overload poses a serious problem for individuals, who can readily become overwhelmed by the sheer amount and velocity of information. Learners need new supports that help them filter out "noise" and meaningfully integrate the relevant "signals." If not addressed, we run the risk of increasing information acquisition to the detriment of deep comprehension and robust knowledge construction. The multilayer, interconnected model we've discussed in this section emphasizes this complexity. The challenge for learning professionals is to help learners navigate through information overload and to develop the internal cognitive, social, and emotional capabilities needed to self-regulate against it. Some strategies to support this have been discussed in prior chapters, including social and emotional competencies (Chapter 4), self-regulated learning skills (Chapter 15), and social learning supports (Chapter 14). Mentoring learners in these areas can help, as can specifically teaching techniques for managing overload including connectivist skills, curation, and metacognition.

6. Help learners use connectivist learning strategies. Connectivism emphasizes the importance of distributed knowledge and capability. For example, rather than knowing how to bake banana bread, one simply needs to know where to find recipes online, how to select the best video tutorials, and which friend to phone when a little extra assistance is needed. Navigating through these technical and social networks is a primary skill—a critical learning strategy—associated with connectivism. Although the multilayered, interconnected model discussed so far has emphasized *instructional* strategies (i.e., those things learning professionals do to help support learning), it's also important to consider *learning* strategies. By definition, these must come from the learners, themselves; however, learning professionals can enhance and support learners' abilities. Instructors and good instructional design can help learners develop their connectivist learning skills and associated self-regulation strategies to help them navigate complex social, cultural, and informational networks.

7. Help learners curate resources and knowledge. Information and communication technologies offer new ways of discovering, organizing, and later retrieving information. Often learning instances and other information can be digitally captured, processed, aggregated, and stored for retrieval across time, contexts, and devices. This notion relates to connectivism, and it highlights the importance of developing related learning strategies (e.g., how to organize and retrieve curated

information). Over the last decade, personal learning environments have become popular; these online systems help learners and their teachers manage learning resources. Looking ahead, learning professionals will need additional tools and mentorship strategies to continue to support such curation activities across increasingly "noisy" and diverse settings.

8. Blend instructor- and learner-controlled strategies. This section has outlined guidance for instructional strategies as well as possible interventions to help develop and activate learners' own internal learning strategies. This final item highlights that both internal expert-directed learning controls as well as learner-directed self-regulatory interventions are critical. Over time, individuals should develop the desire and ability to exert more independent control. However, many learners need help cultivating their self-directed learning abilities, hence a negotiated mix of instructor-controlled and learning-controlled approaches is needed. The role of the instructor in these new multidimensional contexts, therefore, needs to expand and grow in flexibility, shifting to encompass the roles of activator, facilitator, coach, mentor, and advisor (Hattie, 2009; Marr, 1982).

Strategies for Meaningful Future Learning

The prior section outlined eight principles for the application of instructional strategies in the future learning ecosystem context; however, it didn't describe the strategies, themselves. Hundreds of instructional strategies and, likely, thousands of corresponding tactics have been tried and tested. Rather than provide a litany of these, we've identified five generalizable principles of meaningful learning well-suited for instructional strategies in this context.

These methods will help create **active**, **constructive**, **cooperative**, **authentic**, and **intentional** learning interventions.

Meaningful learning is grounded in and driven by epistemological orientations and theoretical foundations that are primarily constructivist, social constructivist, and connectivist in nature. In constructivism, learning is characterized as "constructing" or creating meaning from experience such that knowledge comes from our interpretations of our experiences in an environment and emerges in contexts where it's relevant (Ertmer & Newby, 2013). In other words, the mind filters inputs from an environment or experience to produce its own unique reality or understanding. Therein lies the intentional (goal-directed, regulatory), active (manipulative, observant), constructive (articulative, reflective), and authentic (complex, contextualized) principles of meaningful learning. In social constructivism and connectivism, learning becomes a process of collection, reflection, connection, and publication (Del Moral-Pérez et al., 2013; Ertmer & Newby, 2013). Therein lies the cooperative (collaborative, conversational) principles of meaningful learning.

Strategies in Application: An EMT Example

Consider an example of a young woman who, upon high school graduation, enrolls in an Emergency Medical Technician (EMT) training program. The program incorporates multiple courses delivered via didactic instruction and labs, followed by integrative in-the-field clinical experiences. Throughout the program, her learning is supplemented by various digital tools including e-books, practice simulations, and a micro-learning study app.

At a micro-level, the instructional strategy of **scaffolding** can be used to create a supportive and responsive environment to help the novice EMT progress towards becoming a paramedic. Scaffolding involves assessing what learners can do, helping them reflect on what they know, identifying needs and goals, providing individualized assistance towards these goals, and offering opportunities for learners to internalize and generalize their learning. In this example, the instructors might engage the EMT trainee in intentional, goal-directed, and regulatory behaviors to prompt a connection between what she learned in the EMT training course and how she can extend the physical and cognitive dimensions of EMT training into future paramedic training.

The instructional strategies of **modeling and explaining** can also be used to help transition learners in their learning trajectories. In modeling and explaining, instructors demonstrate a process while also sharing insights beyond the obvious, such as telling learners about why a task is performed in a certain way. In the case of the EMT trainee, her instructors—whether human or AI coaches—can model and explain what, how, and why paramedics perform certain procedures while also demonstrating the social and emotional aspects involved in these tasks. Modeling and explaining can take place in authentic contexts, which helps present the concepts at the appropriate level of complexity and portray the interplay of dimensions associated with them. For instance, for the EMT example, this could be done in a simulated or real ambulatory run. The EMT trainee, in this case, might be asked to articulate, reflect, and engage in constructive thinking through observation of expert performance. She might also be challenged to extend her knowledge beyond her comfort zone, such as to consider the next phase of her professional and personal development as a future paramedic.

In addressing more macro-level instructional interventions, we can expand traditional strategies to incorporate organizational, elaborative, exploratory, metacognitive, collaborative, and problem-solving elements across the various dimensions of learning. These macro-level strategies can be connected or "threaded" to incorporate higher-level objectives, such as encompassing a defined career path or advancing a current professional situation. Each individual's journey through a lifetime of formal and informal experiences is somewhat unique and may incorporate multiple contexts and educational events. Hence mapping and organizing a learner's cohesive transition, with the important consideration of "the spaces in-between" (the meso-level of

design), as well as the integration of instructional experiences and major life events, become important areas of focus for future learning design.

Upon completion of paramedic training, **coaching and mentoring** can be used as crossover instructional strategies to further scaffold learners towards the next phase or experience in their lifelong learning trajectory. Coaching and mentoring are related. They involve observing learner performance and offering assistance to bring it closer to expert performance (coaching), as well as acting as role model, advising, and supporting learners in attaining goals and in overcoming barriers and challenges (mentoring). As learners set goals for real-life situations, coaches and mentors provide support through dialogue, with social negotiation, and by engaging learners in actively seeking information, researching the issues, and finding solutions to meaningful and authentic problems (Dabbagh et al., 2019).

In the EMT example, this means engaging the EMT trainee, who (let's say) is now a paramedic, in **authentic** (complex, contextualized) and **cooperative** (collaborative, conversational) activities to help her think about how to extend her physical, cognitive, emotional, and social knowledge of being a paramedic further, maybe encouraging her to consider the perspectives of a physician's assistant. This might involve shadowing a physician's assistant at a hospital, observing what they do, and actively considering how her current and emerging medical knowledge and skills as well as her social and emotional competencies (such as bedside manner) might apply. This type of experience allows learners to work in authentic settings, and it engages them in collaborative and conversational interactions with their coach or mentor as well as with their peers. All this enables them to share ideas, listen to each other's perspectives, and co-construct knowledge. As illustrated in this example, the instructional strategies of scaffolding, modeling and explaining, and coaching and mentoring can be used as crossover instructional strategies to create meaningful connections that help learners transition across experiences, set lifelong learning goals, and achieve those goals across the lifespan.

Macro-level instructional strategies can inform larger and larger units of instructional and professional development, and adding meta-level structures also helps support a lifetime of growth across multiple careers, experiences, and interests. This supports continual expansion of knowledge, multiple learning itineraries based on learners' competencies and interests, and multiple tools for manipulating resources. This includes not only formal learning experiences but also informal and life experiences, all intimately connected.

Viewing learning across the lifespan as a networked and connected ecosystem of experiences opens new opportunities for instructional strategies. Each individual may have a different learning trajectory and mosaic of experiences threaded together across education and training, major career events, multiple careers, and other lifetime activities. Like a puzzle that's never quite finished, learners progressively add to their learning landscapes while also benefiting from the integration of

STRATEGIES FOR MEANINGFUL LEARNING

Instructional strategies such as scaffolding, modeling and explaining, and coaching and mentoring can support meaningful learning within and across different levels (Dabbagh et al., 2019):

COOPERATIVE (collaborative, conversational)

- Enable collaborative and conversational interactions between learners and instructors, mentors, tutors, or instructional systems
- Encourage learners to engage in collaborative and conversational activities through sharing ideas, listening to each other's perspectives, and co-constructing knowledge
- Help learners work together in communities to accomplish the task at hand

AUTHENTIC (complex, contextualized)

- Use authentic processes and contextualized examples to present concepts and domain knowledge at appropriate levels of complexity
- Engage learners in authentic activities that are complex and contextualized
- Encourage learners to actively seek information, research issues, and find solutions to meaningful and authentic problems

CONSTRUCTIVE (articulative, reflective)

- Enable active and constructive learning by challenging learners to perform beyond their comfort zones
- Engage learners in active and constructive thinking, for instance, by representing their understanding in different ways, using different thought processes, and challenging them to develop and defend their own mental models
- Create opportunities for learners to think constructively while considering experts' performance, articulation, and reflective practice

INTENTIONAL (goal-directed, regulatory)

- Encourage goal-directed and regulatory behavior by keeping learners' intentions at the forefront of the learning task
- Engage learners in reflective and intentional behavior, encouraging them to analyze their actions, compare them to others, and, ultimately, to form expert knowledge and skills
- Help learners set achievable goals and manage the pursuit of these goals through a process of exploration and inquiry

ACTIVE (manipulative, observant)

- Engage learners in active learning through observing the consequences and results of their actions and by assessing and evaluating their knowledge
- Enable learners to consciously think about their observations and actions thereby constructing new knowledge and restructuring their understandings accordingly

the elements within them. The technological advances described throughout this volume have created the capacity to provide learners with connected and cohesive learning across their lifespans.

Summary

Instructional strategies can incorporate interventions, such as scaffolding, modeling and explaining, and coaching and mentoring, to provide the glue that meaningfully supports connected and cohesive experiences across a learner's lifetime. Thinking about the continuum of future learning, we need to consider these strategies at multiple levels—not only within a particular instructional event or course of study, but across learners' longitudinal trajectories. Accordingly, a significant challenge for the future is the differentiated application of instructional interventions across conceptual areas, learners' developmental phases, content modalities, and levels of abstraction—while also considering the impact of composite learning experiences.

Such learning experiences can be implemented using experiential, collaborative, and personalized instructional models that target cognitive, psychomotor, emotional, and social skills across distributed contexts including individual and collaborative activities; these, of course, will also be facilitated by a variety of delivery formats, modalities, and technologies. Thus, we must consider a new model for how to organize and recommend instructional strategies within this non-linear, lifelong, personalized learning continuum. How do we ensure such strategies are coherent to learners and that they improve upon (rather than add noise to) the potentially overloaded learning environment?

How do we help teachers, trainers, mentors, and automated systems, as well as learners themselves, use appropriate strategies in this crowded future learning environment? Many other learning science questions persist. However, it's clear that to realize the full promise of the future learning ecosystem, we need to apply considered strategies across it—strategies that combine micro-and macro-level instructional activities with macro-level considerations, that identify and support "the spaces in-between" learning episodes at the meso-level, and that help learners develop and apply their own learning strategies to navigate the complexity of the world around us.

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