48 Instructional Design Models

Andrew S. Gibbons, Elizabeth Boling, and Kennon M. Smith

Abstract

Design has become increasingly important in a number of technology-related fields. Even the business world is now seen as primarily a designed venue, where better design principles often equate to increased revenue (Baldwin and Clark, Design rules, Vol. 1: The power of modularity, Cambridge, MA: The MIT Press, 2000; Clark et al., Brookings Papers on Economic Activity, 3:729–771, 1987; Martin, The design of business: Why design thinking is the next competitive advantage. Boston, MA: Harvard Business Press, 2009). Research on the design process has increased proportionally, and within the field of instructional design (ID) this research has tended to focus almost exclusively on the use of design models. This chapter examines the emergence of the standard design model in ID, its proliferation, its wide dissemination, and a narrowing of focus which has occurred over time. Parallel and divergent developments in design research outside the field are considered in terms of what might be learned from them. The recommendation is that instructional designers should seek more robust and searching descriptions of design with an eye to advancing how we think about it and therefore how we pursue design (Gibbons and Yanchar, Educ Technol 50(4):16–26, 2010).

Keywords

Design • Instruction • Instructional design • Instructional development • Design model • Instructional design model • Instructional systems design • ADDIE • Systems approach

What Is a Model?

A model can be: (a) a simplified representation of something that exists, or (b) a description of something that could exist. In the terms of this chapter, instructional design models are of the latter type; they describe process by which something can be created, but not the thing which is created (Gibbons & Rogers, 2009).

Many kinds of models pertain to the instructional design process. Some models describe decisions to be made. Others describe the order of decision making or activities carried out during design (Dubberly, 2005; Silvern, 1968), the designer's thinking processes (Brooks, 2010), team interactions (Yang, Moore, & Burton, 1995), design architecture (Gibbons & Rogers, 2009), design documentation (Gibbons, 1997), and the decision-making context (Gibbons, 2011; Young, 2008). Models also differ in their intended audiences and purposes; they may speak to the purposes of administration, marketing, budgeting, or cross-function coordination.

A.S. Gibbons, Ph.D. (✉)
David O. McKay School of Education, Brigham Young University, 150-C McKay Building, Provo, UT 84602, USA
e-mail: andy_gibbons@byu.edu

E. Boling, M.F.A. • K.M. Smith, Ph.D.
Indiana University, Bloomington, IN, USA

J.M. Spector et al. (eds.), *Handbook of Research on Educational Communications and Technology*,
DOI 10.1007/978-1-4614-3185-5_48, © Springer Science+Business Media New York 2014

Smith (2008) observes that the term "design" is used to refer to at least three different aspects of design: (a) to the design acts carried out during the second stage of the ISD process, (b) to the more detailed design acts carried out during the third stage of the ISD process, such as the design of screens, graphics, and formats, and (c) to all of the acts carried out during the entirety of the ISD process. That is, the "D" in ISD is taken by some to stand for "design." By far the most numerous models within ID are those that describe the highest-level processes.

History of Models in ID and Design

Contrary to the popular narrative, the instructional design process models we have today are not directly traceable to behaviorism, programmed instruction, or even to the application of the systems approach. Instructional design process models which emerged in the 1950s and 1960s were relative late-comers; core process elements of instructional design models had by that time been described and widely applied long before. The roots of formal design processes go back to the beginning of the twentieth century. The confluence of complex postwar problems and the emergence of the systems approach catalyzed the formalization of a rational approach to design across many fields of design practice, including instructional design, which had been in use long before in the service of very pragmatic ends. The design models that appeared in the 1950s and 1960s had the extra appeal that they *appeared* to provide a scientific basis for design at a time when science was emerging as a trusted source of progress.

The "Plans"

Between 1912 and 1935 a series of controversial "Plans" (Saettler, 1968) were launched in public schools. The Plans were a reaction to efficient, mass-administered, standardized treatments based on the knowledge-reception model of learning. They were local, grassroots attempts to systematize and individualize instruction (see Table 48.1).

The first of these, the Burk Plan (Burk, 1913), was based on specialized texts which implemented several strategic principles: stepwise introduction of task complexity, control of the pace of introducing new ideas, frequent review of previously mastered material, and adaptive branching used for controlling pace and for remediation. These texts were not designed using a formally specified process, but such a process is implied by the highly structured features that the designs included, since no informal procedure could have produced them in the necessary quantity.

The Burk Plan was terminated in 1919 by the California legislature, but Burk's protégé, Carleton Washburne, established

Table 48.1 Comparative features of three major "Plans" between 1915 and 1935

Feature	Burk (1915–1919)	Washburne (1919–1940)	Morrison (1925–1935)
Self-pacing	x	x	–
Self-instructional	x	x	–
Individual practice	x	x	x
Prepared materials	x	x	x
Based on objectives	x	x	x
Diagnostic tests	x	x	x
Self-admin tests	x	x	x
Criterion referencing	x	x	x
Remedial tutoring	x	x	x
Adaptive reteach	–	–	x

the Winnetka Plan in Illinois (Washburne, 1920), which continued in use until the 1940s and was widely influential. It similarly included among its instructional techniques structured core-subject workbooks and rules for using them, again implying a deliberate design process guiding their creation.

The Morrison Plan (Morrison, 1926) employed a "mastery formula … pre-test, teach, test the result, adapt procedure, teach and test again to the point of actual learning" (p. 79). This plan employed a cybernetic feedback principle prior to its formal expression and popularization during World War II.

The legacy of the Plans is that they focused on specially designed materials which had to be created using a deliberate design process, the essential features of which (objectives, aligned instruction, aligned tests, and evaluation) supplied the backbone of formalized instructional design models that emerged some 20 years later.

During this same period several key developments were unfolding outside education that laid groundwork for the later design methods approaches in architecture and product design. Cross (2004) discusses the motion efficiency studies carried out by Gilbert from 1909 to 1917, a forerunner to the idea that design—like other skilled work—could be made efficient. Overlapping this period, the De Stijl and Bauhaus movements began in Europe, both explicitly embodying a movement away from craft-based design and toward principle-based design.

Tyler and the Eight-Year Study

Between 1930 and 1942 Ralph Tyler formed and tested an approach to design as part of the so-called Eight-Year Study (Kridel & Bullough, 2007; Tyler, 1949), which was conceived to prove the superiority of progressive school programs. Tyler believed that teachers should formulate their own paths to reform, and this philosophy transformed the study into an exploration of how instruction is designed and evaluated. Consequently Tyler's team of researchers assisted instructors in constructing instructional goals, aligning them with instruction, and conducting evaluations, which included field tests.

Tyler produced a syllabus to be used by public school instructors as a textbook on instructional design for teachers: his famous *Basic Principles for Curriculum and Instruction* (Tyler, 1949). In it, he addressed in complex terms each aspect of the design process which had come forward from earlier experimenters. For example, he described "behavioral objectives" as capturing a full net of meaning and associations, a much richer concept than that of isolated and fragmented performances which became common later, and which he criticized in later years (Fishbein & Tyler, 1973). The formalized instructional design models of the 1950s, 1960s, and 1970s were arguably less complete and more mechanical than Tyler's much earlier description of design, but his "four questions" even today form the core concerns of instructional design models (Tyler, 1949, p. 1). These questions express the concerns of the earlier Plans equally well:

- What educational purposes should the school seek to attain?
- What educational experiences can be provided that are likely to attain these purposes?
- How can these educational experiences be effectively organized?
- How can we determine whether these purposes are being attained?

Tyler's questions and the process answers he gave to them represent a contribution to the later-emerging models from the public education sector.

The A-V Movement

Contributions were emerging from other sources as well. Following World War I, and again following World War II, media innovations poured out from the military world into the public domain at an accelerated rate, to become popular academically and commercially (Saettler, 1968): silent instructional film (early 1900s); instructional radio (late 1920s); sound film (early 1930s). Post World War II, educational television, programmed instruction and computers ascended in turn, each viewed as *the* "new medium" of its time. Despite constant increases in available media, prior to 1950 it is difficult to find any detailed descriptions of design processes with the exception of those Tyler created during the Eight-Year Study.

After 1953, however, media-related professional organizations began to come together; these facilitated a shift in focus from the technical preparation of media to the educational uses of media, the selection of appropriate media and the enhancement of its instructional value. The discussion of design gradually emerged as a topic independent from media production.

Professionalization and Finn

James Finn, who held prominent positions in Audio-Visual Education during the 1950s, issued a detailed call to professionalize the field. He enumerated six criteria to be met by a profession: an intellectual technique, application of the technique to practical affairs, a long training period to reach expertise, a professional organization, ethical standards, and a constantly expanding, organized body of intellectual theory (Finn, 1953, p. 7), which, he pointed out, the A-V field did not have (pp. 15–16). He foreshadowed the role of the designer as a specialist, separate from the media production specialists already known to the audio-visual community and the attendant implication that these specialists would require specialized tools, concepts and processes. Finn was recommending, as was Heinich, the adoption of "systems concepts" and "instructional development…as a process and a method to operationalize a systems approach to instruction" (Heinich, 1984, p. 74).

Finn set into motion a tendency toward self-examination that continues to influence the whole educational technology field today. By 1960, he clearly considered media devices to be distractions from the abstract questions concerning their use in instruction, setting up what Shrock describes as "…a tension between 'media people' and 'developers' [which] remains in the field today (1995, p. 17). In 1963 Ely edited a special issue of *Audio-Visual Communication Review* (Ely, 1963) which attempted to answer Finn's call with a definition of the field. This was the first of a series of official definitions issued since then (AECT, 1977; Ely, 1972; Januszewski & Molenda, 2007; Seels & Richey, 1994).

Formalized design was coming into its own in other fields during the same period. As early as 1929 Buckminster Fuller was forming his earliest ideas for what he would call design science, but in the USA during the 1930s and 1940s, product designers were termed "stylists," openly committed to aesthetic variation in design intended to drive a post-war consumer economy. At the same time, in the UK, professionalism in product design was well underway. The Society of Industrial Arts was formed in the UK in 1930, establishing exams for credentialing designers. By 1944 this board had undergone a reform, defined three grades of practice and established a Code of Professional Conduct (Buchanan & Margolin, 1995; Read, 1946).

Teaching Machines and Programmed Learning

The period from 1950 to 1970 was marked—and complicated—by the extraordinary success of Skinner's teaching machines (1958), which he expected to address growing needs for schools and teachers. For a brief period teaching machine manufacturers entered the market at the rate of two per week

(Silvern, 1962), although interest waned when it became clear that comparatively expensive programming and not the machines themselves were responsible for the learning effect.

The excitement around teaching machines simultaneously placed mechanisms and design technology front and center, which Finn argued was a negative development. However, designing programs for teaching machines promoted intense engagement with strategic instructional design processes, which was "a factor in the evolution of the instructional design process" (Lockee, Moore, & Burton, 2004, p. 545). While the actual practice of programming was referred to at the time as an "art" (Markle, 1964), and did not result in an explicit design model, programming required a complex design process, precise design vocabulary, and increased attention to detailed instructional goals, content structure, instructional strategies being used, and an intense cycle of design, tryout, and revision. Significantly, Markle remained opposed to formalizing the programming process itself, choosing instead to emphasize the unique requirements of each design problem. Markle did insist, however, on the rigorous cycle of program improvement through trial and revision.

Emerging Models of Design

In contrast to Markle's insistence on "art," in 1963, Leonard Silvern was creating large fold-out diagrams detailing design process models which used a new terminology and symbology to represent what he called models of the educational design process (Silvern, 1968). Silvern emphasized the process formalization requirement that was created by large, complex design projects involving multiple organizations, tough design problems, and large staffs working over extended periods of time: the kinds of problems being worked on at the time by the military and large industrial organizations. He provided box-by-box functional descriptions of the processes represented on these comprehensive foldout diagrams, and also referenced similar work by Ofeish (1963), who was also building models for the military and industry, where such models had been growing steadily for as much as a decade.

The emerging field of formalized instructional design models was on a parallel track with thinking in the wider, international, arena of design at this time. The Council of Industrial Design, in London, published Archer's "Systematic Method for Designers" (Archer, 1965), which included a 14 page "checklist of activities and events" to be checked off on the six-page "arrow diagram… mounted on the wall adjacent to the designer's drawing board [where] the links in the diagram show what must be done next" (p. 16). Archer and Silvern described design in terms of problems and subproblems, and clearly differentiated the roles of the designer who specifies an artifact and the production engineer who manufactures it.

Briggs

It was Briggs, however, who established both the design process model and its definition in the minds of the new class of workers called educational specialists. This group had previously associated themselves largely with the audio-visual movement, but Briggs defined for them a new path forward by refining their design practice. The discovery that it was the program and not the teaching machine that made the difference left open the question what media combinations could or should be used for instruction. This led to a divergence between device-thinking and abstracted thinking about strategic design structure. This was the problem that first caught Briggs attention. In 1967 he published *Instructional Media*: *A Procedure for the Design of Multi-Media Instruction*, *A Critical Review of Research*, *and Suggestions for Future Research* (Briggs, 1967). His publication introduced several ideas that foreshadowed the future of direction of instructional design concepts and practice, and things would never be the same for instructional designers.

Briggs' goal was to establish the instructional requirements of objectives as the basis for media selection, using newly invented taxonomies of instructional objectives (Bloom, 1956; Gagné, 1965). Gagné and Bloom both held to the principle that from the nature of the instructional objective a "best" approach to instruction could be determined. Significantly, Bloom's work was based on that of his mentor Ralph Tyler, as expressed in *Basic Principles of Curriculum and Instruction*.

Briggs followed this by publishing what he specifically called a "design model" in the *Handbook of Procedures for the Design of Instruction* (1970). He described this "set of procedures for the design of instruction" as a model employing the "systems approach" and comprising "(a) the process of instructional design described in an orderly series of steps, (b) based on research findings when possible, psychological theory, or upon common reasoning, and (c) dependent on empirical tryout [validation] to be judged satisfactory"(1970, p. vii).

Briggs' focus was clearly on process. He described a new category of worker called an "educational specialist" who would have access to superior systematic design techniques, and introduced the idea of "multi-media" instruction meaning that teachers (rather than teaching machines) would play a central role in instruction, even if that role was in service to a preset design. He also conceived of the "package of instruction" (1967, p. 9), bringing objectives, media usage and a unit that publishers could produce profitably. He praised

David Markle's design approach (Markle, 1967) describing it as an important methodological innovation that could be "extended to determination of training objectives and to the determination of specific development steps to be taken" (n.p.). A close examination of Briggs' work at this point shows that he was concerned with issues identical to those of the Plans and Tyler before him. The difference at this point was the rising tide of the emerging systems approach and the increased popularity of engineering solutions which created a ready vocabulary for his ideas in the minds of the audience.

Coincident internationally with Briggs' and Silvern's work, the Royal Institute of British Architects (RIBA, 1965) published a 4-Phase model describing "systematic" design processes, and Gregory (1966) published *The Design Method*. These works were frankly aimed at achieving efficiency in design through defining the process of designing, but also made it clear that the complex work of creation and innovation could not be fully depicted in such models (Archer, 1965). This distinction was evidence of a splitting away from the two-dimensional simplicity of engineering models: a trend which would continue in Europe.

Emergence of the Systems Approach

At the beginning of the Cold War a body of accumulated knowledge about how to approach the design complex systems flooded into academic and public domains from scientists and engineers who had spent the early parts of their careers designing technology systems on an unprecedented military scale. The complexity of these systems required large teams from multiple specialties to engage in careful analysis, problem definition, design of solutions, development of equipment and training, and constant evaluation of program and process quality.

In 1965 Robert Gagné edited *Psychological Principles in System Development* (Gagné, 1965b), a volume to which multiple systems approach practitioners contributed, marking the point at which the systems approach merged into the field of audio-visual instruction to begin forming the field that today comprehends instructional technology, educational technology, instructional systems design, instructional systems technology, and other similar academic titles. The book was one work within a larger body of works in many fields on systems development, but to the members of the instructional design community it represented a monolithic statement about the systems design process whose influence even today silently dominates the discourse of instructional design practice, though few designers today could claim to have read it or even know of its existence.

It is worth noting that Gagné presented two major aspects of the systems approach in his book: (1) an orderly, integrated, multidisciplinary, but not structured, problem-solving process which is rational and systematic; and (2) a set of conceptual tools for designing systems which interact properly with neighbor systems, are controllable, and are adapted and adaptable to their environment. There was little mention in this edited work of general systems theory, which emerged in the social sciences years after the systems approach emerged from its more practical application in wartime military laboratories. The systems approach was a problem solving and designing tool, while general systems theory was a descriptive theory for the scientific study of the behavior of both natural and human-made systems.

Origins of the Systems Approach

The systems approach described in *Psychological Principles* can trace its lineage back to systems engineering, which emerged in England early in World War II (Hughes & Hughes, 2000) under conditions of extreme expedience and physical danger. It was a method for solving for complex problems whose solution had to draw on diverse scientific and engineering specialties through multidisciplinary teams. Systems approaches have recently been described as a way of thinking and problem solving, rather than as a specific process. The systems approach uses a constellation of problem solving concepts, tools, and techniques, many of them mathematical or statistical in nature. Ramo describes the systems approach as "… an intellectual discipline for mobilizing science and technology to attack complex, large-scale problems in an objective, logical, complete and thoroughly professional way" (Ramo & St. Claire, R. K 1998, p. 1). The systems approach involves stages of analysis followed by stages of synthesis (Silvern, 1968). Gagné explained that the goals of the approach center on "the desire to achieve maximal efficiency of system development" and that "systematic plans must be made for how the system is to work" (p. 3), including multiple subsystems that describe not only artifacts, but the operations of many interacting component systems.

The systems approach was atheoretic, meaning that it did not entail theories about the inner working mechanisms of the artifacts designed (domain theories). These theories were brought to the problem by the individual problem solver. This meant that a systems approach could be used equally well by any designer regardless of theoretical bias (Richey, 1986).

Models Proliferate

The systems approach was large, complicated, unpredictable, and required multi-specialized teams to solve big, otherwise-intractable problems. This fit neither the skills nor the budgets of instructional design teams, the funds for which were shrinking. But the idea of the systems approach was still rationally compelling. After 1970 the number of instructional design process models claiming to be based in a systems approach multiplied rapidly in the military, the academic, and the corporate-consulting worlds (Gustafson & Branch, 1997b). The literature on these models became so extensive over the ensuing decades that a comprehensive examination of them was deemed impractical. One of the clear trends during this period was the increasing simplification of representations of the instructional design process from both the robust conception of the systems approach and the complex engineering models of Silvern and his associates. Gibbons (2010) identifies a number of dimensions in which descriptions of design started to trivialize.

The best way to capture the magnitude of model explosion after 1970 may be to note the growing number of models available for review during the 1970s and 1980s by Twelker, Urbach, and Buck (1972), Andrews and Goodson (1980), Gustafson (and later Branch, see below) *which could not be reviewed due to their number*. Gordon and Zemke (2000) make particular mention of the mountains of documentation some of them entailed as they became more detailed. Dubberly (2005) has collected examples of diverse design models from many fields, which provides an interesting contrast to the sameness which overtook many of the models described in the instructional design literature at this time.

Model Creation and Application: Still the Systems Approach?

Design model creation is not scientific. Instructional design models begin as process descriptions at a high level of abstraction and grow through the subdivision of individual high-level processes into subprocesses in a manner described by Taylor and Doughty (1988). The purpose of applying a model is to detail the processes which will be applied for a given project, to solve a given design problem. The subdivision of processes is recursive and can be extensive, as shown by Silvern (1968) whose generic model (p. 99) requires a five-foot-long foldout, fully detailed (p. 59).

Instructional design models continue to multiply, which is a source of puzzlement to some, but Smith (2008) posits that as long as a primary goal of models is to specify processes that would otherwise be decided in situ by designers, there is (will be?) no end to the number of detailed models generated (through the decomposition process) to cover all situations. Since models tend to be couched in process terms rather than in terms of principles, the hope that purely process models will lead to breakthroughs in design thinking is slim.

As design models have proliferated, they have tended to claim a grounding in the systems approach, but as time has gone by the identity of the complex problem solving process has become less and less apparent, and models have tended to be rearrangements of each other, shuffling around boxes which have come increasingly to look more like sequences of procedures and less like fresh analytic approaches to attacking unique design problems.

It is helpful to put these developments in context by comparing attitudes towards design models in instructional technology to positions taken in other design fields during this time period. While there does not seem to have been any coordinated, collaborative effort on the part of professionals from instructional design and those from other fields, there are some instructive points of similarity and difference. Between the mid-1960s, when design models emerged in industrial design, and the 1970s, when design models were proliferating in instructional technology, the first generation of design methods were burgeoning in industrial and architectural design (Lawson, 2005). The formation of the Design Methods Group at U.C. Berkeley in 1967 was preceded by Alexander's *Notes on the Synthesis of Form* (1964), and followed closely by publication of Simon's *The Sciences of the Artificial* in 1969 (Simon, 1969), Alexander's *The Timeless Way of Building* in 1969 (Alexander, 1969; Alexander et al., 1977) and Jones's *Design Methods* in 1970 (Jones, 1970; Margolin, 2010). Simon's Sciences, Alexander's pattern language work, which was extended in 1977 (Alexander, et al), and Jones' methods moved well beyond design models, acknowledging a flexible and critical role for the designer, while still being dedicated to a rationalization of the design process at some level. Moreover, design concepts continued to grow; by 1971 Alexander had disassociated himself from design methods as too restrictive. By 1977 Jones had also distanced himself from design methods (Cross, 1984). Neither author, however, regressed to process models.

Reviews of Design Models

The best way to examine trends and developments in instructional design models in the 1960s and 1970s is through the reviews of models that began to appear quickly (Stamas, 1973; Twelker et al., 1972) and continued periodically up to and through the turn of the century (Andrews & Goodson, 1980; Gustafson, 1981; Gustafson & Branch, 1997a, 1997b, 2002; Gustafson & Powell, 1991).

Andrews and Goodson's review of 40 instructional design models (Andrews & Goodson, 1980) provides a glimpse of the land rush mentality which had come to typify the new professional territory of instructional design models. The clear purpose of the review was to untangle the numerous issues relating to models which had become snarled because few were willing to take time away from the headlong rush to define what the basic issues were. The Andrews and Goodson review became a watershed, the scope and clarity of which has not been duplicated. In their review several issues surfaced, many of which remain unaddressed today: the proliferation of models, the absence of validation, the blurring of terms, incomplete model descriptions, and relation to theory. Today, it is clear that another issue that might have been addressed includes the place of models in achieving robust descriptions of design (Gibbons, 2010; Smith & Boling, 2009).

Early reviews by Twelker et al. (1972) and Andrews and Goodson (1980) included models from a wide body of literature and spoke to technical designers working in high-stakes settings. The series of reviews led by Gustafson between 1981 and 2002 was restricted to the literature reported and available in the ERIC Clearinghouse which focusing almost exclusively on education. These reviews were also intended for a nontechnical and mostly novice audience. This limited the scope and depth of the reviews considerably. At around this time, the term "ADDIE" became generally associated with design models. The origins of the ADDIE term are uncertain (Molenda, 2003), which is symptomatic of the disorganized and unsystematic state of the instructional design literature at the time.

Throughout these reviews of design models, several trends may be discerned. The first is that over this period models lost the energy and robustness of the first-generation systems approach to problem solving that was evident in the work of Gagné (1965) and Briggs (1970). Even as the models became more detailed and complex, in extreme cases they lost sight of the systems approach altogether and were presented as mostly procedural and even linear (Braden, 1996). Accompanying this trend was the notion that designers need have only "a half-dozen really different models in his/her tool bag and know how to modify them for each new situation," (Gustafson, 1981; p. 4). This points to a growing and ultimately entrenched set of ideas: that there can/should be distinctly different kinds of models, that models can be selected for projects using known rules or guidelines, and that there is a process for tailoring models to projects. What these kinds, rules, guidelines, and processes may be has not been articulated (Smith & Boling, 2009).

In the second trend, models representing subprocesses, such as objectives analysis and media selection, and specialized processes, such as computer logic design, appeared in greater numbers and became more common during the 1980s and 1990s. Most of the design processes came under more detailed scrutiny to describe their internal subprocesses. This produced models for subprocesses such as objectives analysis and media selection. These subprocess models were left out of most reviews, and though such detailed subprocess models have since fallen out of vogue, they point to an increased interest at the time in design processes at a fine-grained level and a continuing focus on the procedural aspects of designing at every level.

The third trend revealed by these reviews is something of a flat line rather than a trend. The models included in the reviews were similar enough that time after time they could be compared using the same table format emphasizing the steps in each model and their order. In the Gustafson and Branch reviews (1997a, 1997b, 2002) some deeper analysis and additional rigor were introduced. Gustafson lamented the lack of progression across generations of models and the lack of knowledge or design improvements flowing from them, despite their proliferation (1981, p. 1), but there was no sign at this time that any view of design or development outside of process-oriented models was being seriously explored.

Over time, instructional design became invested in fewer models, found mostly in textbooks, and mainly tailored to the needs of a novice audience consisting of public school teachers and beginning graduate students. Meanwhile, in the larger world of design research, architectural and product design was pursuing second-generation design methods (Rith & Dubberly, 2006; Rittel, 1973). Schön (1987) was pioneering empirical studies of designing which led to robust descriptions of a designer's "conversation" with a design problem, and multiple journals focused on research into design were founded (Margolin, 2010). Critiques of design models, like the RIBA model which was still in use (1965), were based in further and rigorous empirical studies of designers (Cross, Christaans, & Dorst, 1997) and soon process models were being repositioned outside of instructional design circles as tools with severely limited utility (Lawson, 1980).

Issues

Models lost the energy and robustness of the first-generation systems approach as they were simplified to include ever-larger populations of novice designers. Some models lost the spirit of the loose-jointed systems approach to problem solving altogether. The growth of design models accomplished by revising and rearranging the same set of basic elements produced a narrow view that ultimately isolated the instructional design practitioner from outside views of design which might have enriched the concept of design and led to an expansion or redirection of design practices (Smith & Boling, 2009). An accompanying focus on the visual representation of design models also led to the impression that the process of designing was rational and sequential because various actions were depicted as bounded, ordered shapes. The depiction of cybernetic iteration, generally shown by arrows or repeated elements in a diagram, appeared in high-level graphic representations masked the cybernetic thinking and judging processes which in actuality take place at the finest level of granularity and all levels in between.

Conclusion

The point of this account of ID model history has been to show that popular misconceptions about the origins and nature of models have obscured our understanding of the design-related problems such models were intended to solve as well as the concepts that were most central to their original development (Gibbons, 2010). Having neglected to focus on the core concepts and the idea that the systems approach was domain-theory-agnostic, we have over time added to the models domain-specific baggage which restricts their application to a narrow range of problems which make certain assumptions (for example, the assumption that task analysis is *the* appropriate form of content analysis), thereby making them applicable to only a stereotyped set of problems for which they tend to produce stereotyped solutions. By focusing on the models themselves, and by associating the narrative of their history with specific philosophical and theoretical positions, especially behaviorism, we have entered a blind alley in which the way forward for many seems to be either: (a) continuing to rearrange and reword existing models, or (b) viewing models with suspicion and advocating their marginalization.

Meanwhile, the design literature from many other design-related fields is reminding us that the problems we face in designing are common to other fields as well and that there are many possibilities yet to consider (Brooks, 2010; Cross, 2007; Goel & Pirolli, 1992; Kruger & Cross, 2006; Lawson, 2005; Lawson & Dorst, 2009; Rowe, 1987).

References

AECT. (1977). *The definition of educational technology*. Washington, DC: Association for Educational Communications and Technology.

Alexander, C. (1964). *Notes on the synthesis of form*. Boston: Harvard University Press.

Alexander, C. (1969). *The timeless way of building*. New York: Oxford University Press.

Alexander, C., Ishikawa, S., & Silverstein, M. (1977). *A pattern language: Towns, building, construction*. New York: Oxford University Press.

*Andrews, D. H., & Goodson, L. A. (1980). A comparative analysis of models of instructional design. *Journal of Instructional Development*, *3*(4), 2–16.

Archer, B. (1965). Systematic method for designers. London: The Design Council.

*Baldwin, C. Y., & Clark, K. B. (2000). *Design rules, Vol. 1: The power of modularity*. Cambridge, MA: MIT Press.

Bloom, B. (1956). *Taxonomy of educational objectives, Handbook I: Cognitive domain*. New York: David McKay.

Braden, R. (1996). The case for linear instructional design and development: A commentary on models, challenges, and myths. *Educational Technology, 36*(2), 5–23.

*Briggs, L. J. (1967). *Instructional media: A procedure for the design of multi-media instruction, a critical review of research, and suggestions for future research*. Washington, DC: American Institutes for Research.

*Briggs, L. J. (1970). *Handbook of procedures for the design of instruction*. Washington, DC: American Institutes for Research.

Brooks, F. P. (2010). *The design of design: Essays from a computer scientist*. Boston: Addison-Wesley Professional.

Buchanan, R., & Margolin, V. (1995). *The idea of design*. Cambridge, MA: The MIT Press.

Burk, F. L. (1913). *Lock-step schooling and a remedy*. Sacramento, CA: Superintendent of State Printing.

Cross, N. (1984). *Developments in design methodology*. Chichester, England: Wiley.

Cross, N. (2004). Expertise in design: An overview. *Design Studies, 25*(5), 427–441.

Cross, N. (2007). *Designerly ways of knowing*. London: Springer-Verlag.

Cross, N., Christaans, H., & Dorst, K. (Eds.). (1997). *Analysing design activity*. Chichester: Wiley.

Dubberly, H. (2005). How do you design? A compendium of models. Retrieved from http://www.dubberly.com/articles/how-do-you-design.html.

Ely, D. P. (Ed.) (1963). The changing role of the audiovisual process in education: A definition and a glossary of related terms. *Audio-visual communication review*, *11*(1), entire issue.

Ely, D. P. (1972). The field of educational technology: A statement of definition. *Audiovisual Instruction, 17*(8), 36–43.

*Finn, J. D. (1953). Professionalizing the audio-visual field. *Audio-Visual Communications Review*, *1*(1), 6–17.

Fishbein, J. M., & Tyler, R. W. (1973). The father of behavioral objectives criticizes the: An interview with Ralph Tyler. *Phi Delta Kappan, 55*(1), 55–57.

Gagné, R. M. (1965). *The conditions of learning* (1st ed.). New York: Holt, Rinehart & Winston.

*Gagné, R. M. (Ed.) (1965b). *Psychological principles in system development*. New York: Holt Rinehart & Winston.

Gibbons, A. S. (1997). Design and documentation: The state of the art. *TechTrends, 43*(3), 27–32.

Gibbons, A. S. (2011). Contexts of instructional design. *Journal of Applied Instructional Design, 1*(1), 5–12.

Gibbons, A., & Rogers, P. (2009). The architecture of instructional theory. In C. Reigeluth & A. Carr-Chellman (Eds.), *Instructional-design theories and models* (Vol. III). New York: Routledge.

Gibbons, A. S., & Yanchar, S. C. (2010). An alternative view of the instructional design process: A response to Smith and Boling. *Educational Technology, 50*(4), 16–26.

Goel, V., & Pirolli, P. (1992). The structure of design problem spaces. *Cognitive Science, 16*(3), 395–429.

Gordon, J., & Zemke, R. (2000). The attack on ISD. *Training, 37*(4), 43–53.

Gustafson, K. L. (1981). *Survey of instructional development models*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. ED 211097.

Gustafson, K. L., & Branch, R. M. (1997a). *Survey of instructional development models* (3rd ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology. ED 411780.

Gustafson, K. L., & Branch, R. M. (1997b). Revisionsing models of instructional development. *Educational Technology Research and Development, 45*(3), 73–89.

Gustafson, K. L., & Branch, R. M. (2002). *Survey of instructional development models* (4th ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology. ED 477517.

Gustafson, K. L., & Powell, G. C. (1991). *Survey of instructional development models with an annotated ERIC bibliography* (2nd ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology. ED 335027.

Gregory, S. A. (Ed). (1966). *The design method*. London, UK: The Butterworth Press.

Heinich, R. (1984). The proper study of instructional technology. *Educational Communications and Technology Journal, 32*(2), 67–87.

Hughes, A., & Hughes, T. (Eds.). (2000). *Systems, experts, and computers: The systems approach in management and engineering, World War II and after*. Cambridge, MA: The MIT Press.

Januszewski, A., & Molenda, M. (Eds.). (2007). *Educational technology: A definition with commentary*. New York: Routledge.

Jones, J. C. (1970). *Design methods: Seeds of human futures*. London: Wiley-Interscience.

*Kridel, C., & Bullough, R. V. (2007). *Stories of the eight-year study: Reexamining Secondary education in America*. Albany: State University of New York Press.

Kruger, C., & Cross, N. (2006). Solution driven versus problem driven design: Strategies and outcomes. *Design Studies, 27*, 527–548.

Lawson, B. (1980). *How designers think*. New York: Architectural.

Lawson, B. (2005). *How designers think* (3rd ed.). London, UK: Architectural.

Lawson, B., & Dorst, K. (2009). *Design expertise*. Oxford: Elsevier.

Lockee, B., Moore, D., & Burton, J. (2004). Foundations of programmed instruction. In D. H. Jonassen (Ed.), *Handbook of research in educational communications technology* (2nd ed., pp. 545–569). Bloomington, IN: Association for Educational Communications and Technology.

Margolin, V. (2010). *Design research: Towards a history.* Paper presented at the Design Research Society Conference, Montreal, Canada.

Markle, S. M. (1964). The Harvard teaching machines project: The first hundred days. *Audio-Visual Communications Review, 12*(3), 344–351.

Markle, D. (1967). *The development of the Bell System First Aid and Personal Safety course: An exercise in the application of empirical methods to instructional systems design: Final report*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. ED 026871.

Martin, R. (2009). *The design of business: Why design thinking is the next competitive advantage*. Boston, MA: Harvard Business Press.

Molenda, M. (2003). The ADDIE model. In A. Kovalchick & K. Dawson (Eds.), *Educational technology: An encyclopedia*. Santa Barbara, CA: ABC-Clio.

Morrison, H. C. (1926). *The practice of teaching in the secondary school*. Chicago: The University of Chicago Press.

Ofeish, G. D. (1963/2008). Tomorrow's educational engineers. Republished in *Educational Technology*, *48*(1), 58–59.

Ramo, S., & St. Claire, R. K. (1998). Retrieved December 26, 2011, from http://www.incose.org/productspubs/doc/systemsapproach.pdf

Read, H. (1946). *The practice of design*. London: Lund Humphries.

Richey, R. (1986). *The theoretical and conceptual bases of instructional design*. London: Kogan Page.

Rith, C., & Dubberly, H. (2006). Why Horst W. J. Rittel matters. *Design Issues, 22*(4), 1–3.

Rittel, H. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*, 155–169.

Rowe, P. (1987). *Design thinking*. Cambridge, MA: The MIT Press.

Royal Institute of British Architects. (1965). *Handbook of architectural practice and management*. London, UK: RIBA.

Saettler, P. (1968). *A history of instructional technology*. New York: McGraw-Hill.

Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco, CA: Jossey-Bass.

Seels, B., & Richey, R. (1994). *Instructional technology: The definition and domains of the field*. Washington, DC: Association for Educational Communications and Technology.

Shrock, S. A. (1995). A brief history of instructional development. In G. Anglin (Ed.), *Instructional technology, past, present and future* (2nd ed., pp. 11–19). Englewood, CO: Libraries Unlimited.

Silvern, L. C. (1962). Teaching machine technology: The state of the art. *Audio-Visual Communications Review, 10*(3), 204–217.

Silvern, L. C. (1968). *Systems engineering of education I: Evolution of systems thinking in education*. Los Angeles, CA: Education and Training Consultants Co.

Simon, H. (1969). *Sciences of the artificial* (3rd ed.). Cambridge, MA: The MIT Press.

Skinner, B. F. (1958). Teaching machines. *Science, 128*(3330), 969–977.

Smith, K. M. (2008). *Meanings of "design" in instructional technology: A conceptual analysis based on the field's foundational literature* (Doctoral dissertation, Indiana University, 2008). *Dissertation Abstracts International, 69–08*, 3122A.

*Smith, K., & Boling, E. (2009). What do we make of design? Design as a concept in educational technology. *Educational Technology*, *49*(4), 3–17.

Stamas, S. T. (1973). *A descriptive study of a synthesized operational instructional development model, reporting its effectiveness, efficiency, and the cognitive and affective influence of the developmental process on a client*. Unpublished Ph.D. Dissertation, Michigan State University.

Taylor, R., & Doughty, P. L. (1988). Instructional development models: Analysis at the task and subtask levels. *Journal of Instructional Development, 11*(4), 19–28.

Twelker, P. A., Urbach, F. D., & Buck, J. E. (1972). *The systematic development of instruction: An overview and basic guide to the literature*. Syracuse, NY: ERIC Clearinghouse on Educational Media and Technology. ED 059629, EM 009673.

Tyler, R. W. (1949). *Basic principles of curriculum and instruction*. Chicago: University of Chicago Press.

Washburne, C. W. (1920). The individual system in Winnetka. *The Elementary School Journal, 21*(1), 52–68.

Yang, C., Moore, D. M., & Burton, J. K. (1995). Managing courseware production: An instructional design model with a software engineering approach. *Educational Technology Research and Development, 43*(4), 60–70.

Young, R. A. (2008). An integrated model of designing to aid understanding of the complexity paradigm in design practice. *Futures, 40*(6), 561–576 (Retrieved from doi:10.1016/j.futures.2007.11.005.).