17 pages, 4814 word, 27115 chars

max 12-18 pages, 5000-8000 words

In: Hug, T. & Lindner, M. (Eds.) Didactics of Microlearning. Muenster: Waxmann

Microlearning as a challenge for instructional design

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Traditionally, models of instructional design presume that (e)learning is organized as lessons or courses. But with the growing importance of microcontent and elearning scenarios labeled as “web 2.0”, this assumption of models of instructional design is challenged. If users arrange their personal learning environments themselves by aggregating microcontent, why would we need (models of) instructional design?

The following chapter discusses the role of instructional design in theses scenarios. It presents different views on instructional design: the American tradition which views instructional design as an engineering task (which eventually can be delegated to a computer algorithm), the German tradition of Didaktik which emphasizes the situative and emergent properties of instruction and the “Hypertext-Wiki” paradigm, which focuses on learning as a user-generated activity. In an elearning scenario that follows a “web 2.0” approach instructional design has to integrate these perspectives. It therefore puts forward the argument that in the future instructional design even will be more complex and challenging than before.

1 Learning with small units

When we think of instructional design, we think of lessons lasting 45 minutes or more, of courses consisting of several lessons over some weeks or of curricula for classes or schools. Current theories of instructional design typically distinguish between the *micro level* of instructional design that relates to the structure of a single lesson, the *meso level* which describes a course structure and the *macro level,* the curriculum of a program or a school. Now, small chunks of “microcontent” for learning and new technologies for distribution and aggregating these contents over the internet are becoming available increasingly. Microcontent relates to a single internet resource, which can be referenced directly by a URL, and may consist of a slide of a presentation, parts of an animation sequence, an interview, a test question … These contents all relate to entities *below* the course or lesson level.

Also, an elearning lesson and course typically does have some kind of temporal dramaturgy; it consists of, for example, an opening, a presentation, a section for exercises and a closing. Instructional design models discuss the sequencing of "elements" within a lesson and present guidelines on how to arrange lessons for courses. "Nine events of instruction" from Gagné (1985; Gagné, Briggs, & Wager, 1988) is such a model for sequencing instruction that has reached much attention in teacher education as well as in the realm of elearning. Essentially, these models assume that "good" instruction has to follow a certain temporal dramaturgy. Merrill (1994) elaborated and applied these concepts to computer based instruction. His early "component display theory" relies on the idea that the optimal sequence for instruction primarily depends on the type of content you want to teach: The teaching of facts, concepts, procedures or principals requires different type of instructional elements and lesson sequences. They mainly differ with respect to the amount and timing of abstract vs. concrete information and teacher vs. student led activities.

Now, when a (elearning) lesson is split up into smaller units of segments of – for example – 5-15 minutes of learning time, we abandon the lesson dramaturgy and have the basic elements (also called "assets") that had been assembled into a course beforehand – by the instructional designer or teacher. These elements could consist, for example, of a single presentation (slide?), an exercise sheet (or a single exercise?), a case study or a short test. If they shall be delivered for use as *stand-alone* learning units, it is obvious that they must be organized differently and we arrive at the question: What actually would be instructional design on the level of microcontent? And: what happens to instructional design if we move below the unit of a lesson? Does it become obsolete because the learner him-/herself will choose and arrange the elements and thus, construct the sequence of a "lesson design"?

2 Instructional design: an engineering approach to E-Learning

To answer these questions, we will first look at features of planning and designing elearning applications. Compared to traditional FTF-teaching, E-learning products need a very precise planning. If some unexpected problem occurs during learning (the "delivery"), it is difficult and costly to modify learning materials after they have been implemented. In contrast, a teacher (hopefully) can adapt to situational demands in a classroom more easily and will be able to change a teaching strategy within seconds if the situation requires it. Albeit all efforts of "artificial intelligence", technology based learning applications still are far less diagnostic than teachers in FTF scenarios. The instructional designer of an online learning environment might receive usage statistics and evaluation results but typically does not experience the immediacy of responses from human learners in a FTF-situation, when they e.g. complain about materials – and even if, s/he had a direct relation with learners it typically will not be possible to modify E-Learning materials and lessons instantly.

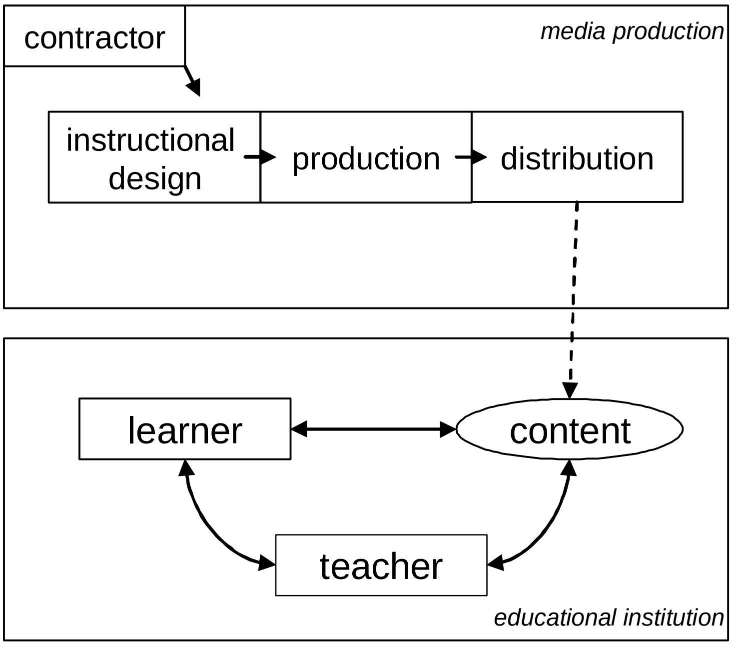

Fig 1: Instructional Media as a product

Traditional theories of instructional design reflect this clear distinction between instructional designers on the one hand and the learner / the teacher on the other hand (s. fig.1). It is the instructional designer, who selects learning materials and defines sequences through lessons and courses - after analyzing learners and contents and defining the conditions of learning, e.g. the learning objectives.

E-Learning products then are solutions for a certain context and a certain instructional goal, for example: a computer based training program for teaching Business English for a certain group of adult learners in further education. Instructional design models describe analytic procedures to unravel the didactical structure of such an "instructional problem" and they provide "blueprints" for selecting an appropriate instructional approach (or "instructional method") based on these analyses. Typical procedures are, for example, target group and learner analysis, task or content analyses (Jonassen, Hannum, & Tessmer, 1989). These analytical procedures provide the "toolbox" for instructional design and constitute the professional competence of instructional designers to a major extent.

Models and procedures of instructional design are based on the idea that instructional decisions must rest on an analysis of the context and its constraints: the learners, the learning situation, the institutional and cultural context: instruction should be planned to exactly fit these conditions.

Consequently, instructional design theories guide instructional designers to select and elaborate instructional materials and lessons. According to Reigeluth (1998) instructional design theories comprise of the following elements:

- instructional conditions: What is to be learned? Who is the learner? What are situational / developmental constraints (time, money, resources)?
- desired instructional outcomes: What are the desired levels of appeal, effectiveness and efficiency?
- instructional methods: Given certain instructional conditions, what are appropriate instructional methods to reach the desired instructional outcomes?

"Problem based learning", for example, is an instructional method that has attracted much research and discussion. But as Reigeluth (1998) points out, PBL is not an instructional design model in itself: It can be an *element* of an instructional design model, that describes when this method will result in certain defined outcomes and how it should be implemented to reach these results.

Hence, *instructional design* is being conceptualized similar to an engineering approach. In its most general sense an engineering approach relates to a transformation of a given state into a desired state with instruments and means grounded in scientific methodology. Similarly, the instructional designer is finding a solution that helps a learner to acquire certain knowledge.

With the rise of constructivism in instructional science in the early 1990s, instructional design models have been questioned quite fundamentally (Jonassen, 1990; Merrill, 1991; Tripp & Bichelmeyer, 1990). When learners themselves are acknowledged as constructers of their learning, what is the role of "instructional design" then? Does it become obsolete or do we need alternative models? Some proponents of instructional design, like David Merrill, do not see a necessity for a fundamental change. According to Merrill, the basic design issues and analytical procedures are the same no matter what instructional approach or method one prefers. The critics argue, on the other hand, that – with the new view to learning - traditional linear models of instructional design should be abandoned (Braden, 1996), because they essentially rely on the asymmetry between learners and instructional designers. Alternative models based on current approaches of (software) engineering, like rapid prototyping, participatory design or usability engineering, give the voice of users a more prominent role in the development process and therefore reduce the asymmetry between learners and designers.

It is, however, interesting to note that the "classic" approaches to instructional design, so far, have not been abandoned and without much refinement are still being published and taught quite vividly. This might be attributed to the fact that the classical models can be taken up rather intuitively by students of instructional design. But it also might be an indication that the essential elements of instructional design are still valid.

3 Computer algorithms for instructional design decisions

Since the early days of computer based learning, this model of producing instructional materials always has been criticized as being expensive and soon the idea came up that materials should be produced for reusing them in several applications. A "handcrafted" elearning application exactly tailored to the needs of a single group of learners in a single institution at a single point in time obviously in many cases is too expensive to produce. Why not let the *computer* select and sequence instruction instead of the (expensive) instructional designer?

An elearning course could be broken up into smaller units that can be reused in other courses and reassembled into new sequences with a high degree of flexibility. If certain information about these units are provided then the computer could select the appropriate units for the learner and thus, produce the learning sequence.

It is interesting to note that the problem of reusability actually is being discussed ever since computers have been used for teaching. The idea of a computer algorithm that sequences learning material on the basis of some metadata (e.g. degree of difficulty) was already outlined and implemented by Helmar Frank, then at the University of Education in Berlin, in the 1960s (Frank, 1969; Frank & Graf, 1967). In the 1980s, intelligent tutoring systems were another attempt to let the computer sequence learning elements at runtime and depending on the progress of the learner. In the 1990s, this line of discussion was continued with approaches to "automating instructional design" (Tennyson & Barron, 1995) which eventually leads to the current discussion about "reusable learning objects".

These approaches are built on the assumption that the computer should select and sequence instruction based on small units of learning materials. The sequence should be generated by the computer; either based on data the computer would interfere from analyzing user inputs (according to the vision of "artificial intelligence") or based on metadata the author provided before. After many years of research, it must be acknowledged that both approaches have not solved the problem of reusability in the practical field yet. It has turned out that implementing procedures to analyze learners while working on learning applications in most cases is far too complicated. Eventually, they fail to provide the necessary information for computer algorithms to sequence "intelligent" instruction.

On the other side, it has turned out that the standardization of metadata for describing learning elements is very difficult to accomplish due to cultural and contextual differences between different languages and meanings. We are still lacking accepted standards for metadata to describe learning elements, such as "level of difficulty" or features of a "target group". Furthermore, authors are quite reluctant to provide metadata and "obey" to standards they feel compelled to use. They do not experience the added value of this additional work, which makes the production of learning materials even more expensive.

After all, the question arises if the selection and sequencing of learning materials might not be easier done by learners themselves – instead of instructional designers or computers? In the early 1990s researches in the field of computer based learning were faced with the sudden success of hypertext for learning. Before this, it was always taken for granted that a didactically sound CBT application would provide paths that guide learners. It was assumed that by providing and keeping learners on a certain track they would reach a specified learning objective more reliably. This assumption, however, is being questioned – at least for learners that are willing and are able to find their way for acquiring knowledge. Furthermore, on a superior level, it has become an important goal to develop "digital literacy" and educate learners as competent users and participants in a knowledge based society.

There has been much discussion if and when learners are able to successfully learn with open hypertexts that do not force users to obey to a certain sequential sequence of text and assignments. But the discussion also points out that even if learners are not – yet – able to learn in such open environments, they should (supported to) acquire the competency to use such environments appropriately.

Recently, this line of reasoning has been reinforced with the discussion about "Wikis" as tools for the collaborative production of contents. Now, users not only generate their own *sequences* through given materials, they have a very easy tool to actively participate in the *production* of such materials.

4 Didaktik: Less planning for better instruction?

Instructional design has been described as an engineering approach to selecting and sequencing instructional elements. With "learning objects", these decisions eventually could be delegated to a computer algorithm.

The German tradition of Didaktik presents a different, rather opposite view to the “design” of instruction: The fundamental assumption in this line of reasoning is: Instruction can not be planned, instruction can only be prepared. Instruction, that enables learners to acquire a level of education that can be qualified as “Bildung”, must allow for a high flexibility in a lesson or course structure. Some authors even see interruptions and interferences as “the” fertile moments that allow for Bildung. Figure 1 presents a basic model of didactical design that relates to the German tradition of Didaktik and to the work of Heimann, Schulz & Otto (1965), that is being discussed in more detail by Norm Friesen in this book.

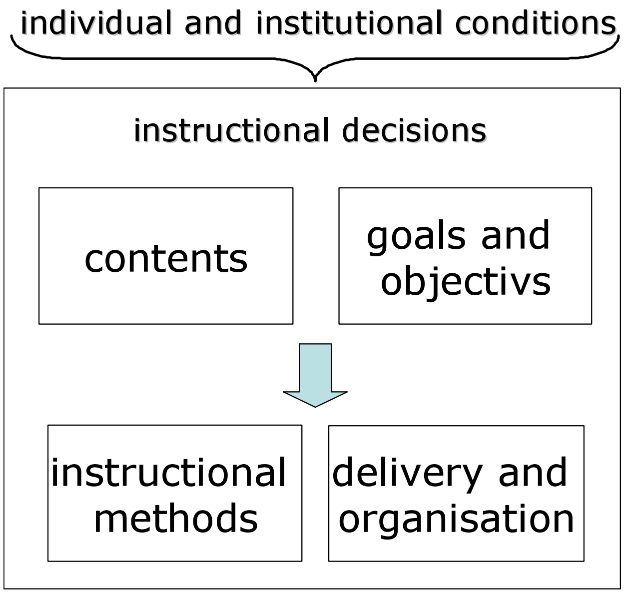

Fig. 1 A basic model of didactical design

Though it is acknowledged that a learner can be “taught” and “trained” to some extent, the tradition of Didaktik emphasizes that a certain level of education can only be reached by the learner her-/himself. A teacher even should be cautious to not “disturb” the learner by some highly “over-“planned lesson design. Bildung can (!) emerge, if teachers offer themselves as a person to truly interact with the learner and therefore permit encounters from person to person. The concept of “interaction” here can be related to the tradition of *symbolic interactionism* by Herbert Blumer and Georg Herbert Mead that emphasize the mutual exchange of meaning which is different than the idea of a transmission of knowledge from one person to another. It also can be related to the person-centered approach of Carl Rogers (1961) and the humanistic psychology movement. Teachers then should be open to the situational demands and to the emergent process of interaction between persons.

The work of a teacher is to be seen more as a service, where the learner is supported to co-produce a certain (learning) result by him-/herself. It becomes obvious that this line of reasoning is rather skeptical to approaches of “rigorous” planning of instructional settings. Consequently, also the analytical procedures that instructional design models suggest are questioned. They are being criticized as methods that do not help teachers much but might even narrow their views and interfere with the ability to really “interact” with learners.

If we apply this approach to elearning this would mean that an instructional designer should be very careful not to “over-plan” learning by defining strict paths through a learning environment that consists of technical artifacts and to restrict the use of learning tools unnecessarily. The approach of Didaktik points out to the limits of learning with “materials” and emphasizes the social nature of ambitious learning (= for “Bildung”). It therefore provides a theoretical foundation for using “social software” in elearning that enhances the interchange between humans while working on tasks or discussing topics with sophisticated technological means.

If we follow this argument we would consider learning materials as starting points for individual reflections as well as discussions with others. The instructional designers provide materials and tools for learning and arrange them in a learning environment that encourages individual and social activities. Furthermore, teachers should be available as tutors that should support and encourage learners to direct their learning activities.

5 Instructional Design and Web 2.0

Currently, the internet is going through an interesting metamorphosis, which is indicated by the somewhat vague term “Web 2.0”. This development can be interpreted as a technological innovation that refers to social software, weblogs, user-generated content and tagging. But more importantly, it implies a different view to the web. The internet gradually becomes ubiquitous and a part of life. Borders that existed before tend to vanish and users develop a different use of the internet:

(a) The boundary between users and authors dissolves: There used to be a clear distinction between authors and users of a web page. Now, user-generated content is recognized as a very valuable source and thus, users become authors.

(b) The boundary between local and remote is disappearing. My data and my tools increasingly are going “into” the web, whereas my local computer becomes part of the internet and can act as a public server.

(c) The boundary between “public” and “private” is changing: More of my private data move into the web. Weblogs, shared photos or bookmarks, for example, are made available on the internet and disclose formerly private information.

These changes have implications for the design of elearning environments. Consequently, Stephan Downes uses the term “E-Learning 2.0“ to refer to the transition, computer based learning is currently undergoing. In this perspective, users will learn in an environment that provides a lot of content for learning and tools to work on these materials individually, with others or with the guide of a tutor. For the user, this “personal learning environment” is not a separate space on the internet, it is an essential part of the users workspace. It should be highly integrated with the users’ framework of tools for his/her personal use of the internet. An instructional designer would arrange some of the materials and tools the learner will work on, but would also arrange the environment to be open to the vast sources and tools the internet provide, thus, providing a soft transition between the learning environment and the “other” internet.

The border between the inside and the outside of the learning environment becomes permeable: Content is being aggregated outside of the learning environment and is made available for the learner. Contents created by the learners are made accessible for the outside world. All this is accomplished by using the mechanism of XML-feeds with varying degree of complexity. These feeds provide a solution to link a learning environment with the “outside”.

The growing interest towards “microcontent” for learning can be related to this line of discussion. The learners themselves are gaining competencies to construct their personal environments where they select and sequence contents available on the internet. Then, the internet with its vast resources itself becomes the primary “knowledge base” that is transformed to “learning material” not by instructional designers or computer algorithms but the learner him-/herself.

Obviously, this scenario is different from elearning scenarios typically used today. They rely on learning platforms that for the most part are being used to distribute or download documents. These platforms essentially are based on the concept that all learning contents and activities should be brought onto the learning platform. With this, they are islands on the internet without many connections to other resources or tools. They force the author / teacher to import all materials into the learning environment, they constrain learners to the tools the platform provides – many of them less capable and appealing than other tools available on the net. And they prevent contents that are being generated during the learning process to be fed to other applications to the net. Certainly, learning platforms will soon deliver new versions of their software that might include some of these features. But the question remains, why we would need learning platforms at all? A Web 2.0 approach to E-Learning would argue that the “personal learning environment” should be arranged on top of the personal workspace of internet users and should rely on mechanisms the internet provide for sharing information and tools on the net.

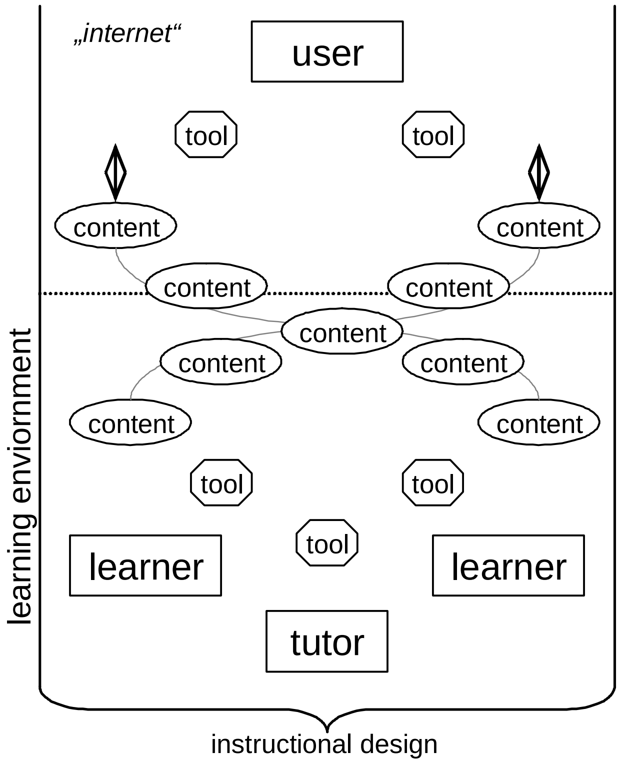

Fig. 2: Instructional Design for Web 2.0 - Enviornments

In such a scenario, the task of instructional design would imply to provide an arrangement of contents and tools that can be intrinsically interwoven with the personal workspace of the learner. The following paragraphs present principles for designing web 2.0 based elearning can be derived.

Guidelines for a eleanring scenario following a “Web 2.0” approach

1. An elearning environment should be perceived as a “gate” to the internet with paths to existing materials and contents on the net as well as materials that have been developed / assemebled / uploaded just for this environment (especially assignments for learning).

2. The learning portal aggregates contents from the net and integrates them as an integral part of the learning environment. These materials typically consist of a low complexity ("microcontent") and are fetched by XML-feeds from other sites.

3. Complex materials can be integrated as learning objects that contain learning materials as well as metadata describing the content, e.g. a sequences for delivering the content.

4. Materials that are being produced within the learning environment should be offered as feeds for reuse at other sites on the net, e.g. for delivery on mobile devices.

5. Learners and teachers / authors use the same tools for working with contents of various kinds, for editing and sharing documents, like weblogs, wikis, forum, pictures, calendars. Teachers and learners actively participate in developing the learning environment – with small differences regarding administrative rights to the learning environment.

6. In order to find information and to share them with others teachers as well as learners use free tags or tags from a taxonomy to describe these information.

7. As far as possible, users can choose tools of their choice to produce and work on content. Learners are encouraged to arrange their own digital work space and to integrate existing tools to construct and share documents.

8. There is a smooth transition between the personal learning environment and the environment people use for their work and other personal activities on the net. Teaching means observing, participating and evaluating the individual and social learning activities within the learning environment.

9. The environment supports social group processes by making visible what tools the users prefer and providing direct access to these tools (e.g. furl or del.icio.us). This does also relate to the use of communication tools. Users should be free to use those tools they prefer. The learning environment simply presents which tool a user prefers to be reached on the net (e.g. ICQ, Yahoo, Skype). Furthermore, it displays if the user currently is available with one of these tools.

10. The system supports community building by presenting who the members of the group are (background, interests, competencies ..), how they have contributed so far, how often these contributions have been accessed and evaluated by others. Thus, the system publishes the degree of personal engagement of each user.

11. It should be attractive to become a member of the community. Registrated users and members of learning groups should enjoy certain privileges. They have access to more information and gain more rights, e.g. to promote information to the front page and to comment immediately).

12. The environment documents the learning activities and results automatically. Contributions become visible to other learners and the teacher, they can be included directly into an e-portfolio of the user (and the institution).

13. Learners are encouraged to reflect their learning activities (Did I set appropriate goals? Did I make a sufficient progress?), for example with a Weblog.

14. An elearning provider generates an added value to customers by supplying

- new and re-arranged (sequenced) (micro-) contents for the learning environment,
- assignments that structure the learning process and
- different variants of tutorial support (including examination and certification).

15. Teachers provide a role model. They are actively engaged and show their presence in the learning environment, e.g. by using the tools the environment offers, by supplying personal information, by supplying materials and participating in discussions, by using a weblog and working on wikis. They react on feedback and error messages immediately.

This short description of an elearning scenario that follows a “web 2.0” approach outlines some of the tasks instructional design has to address to develop such a scenario. It demonstrates that this design task to some extent relates to *all* four views on instructional design presented before:

- Instructional design as an engineering task (sensu Gagné): Materials and tools must be developed to fit the situational demands of the learning context. They must be based on a precise analysis of didactical variables: task analysis, learning objectives, target group characteristics or didactical methods.
- Instructional design can be delegated to a computer algorithm (the “learning object” approach): Reusable learning objects can be integrated that present a certain sequence depending on parameters the learning environment provides.
- Instructional design as a situational, emergent action (the Didaktik tradition): The learning process can be prepared but not completely prear-

ranged. The environment should support “real” interactions between learners and tutors.

- Instructional design as a user-generated activity (the “Hypertext + Wiki”-Paradigm): The environment should encourage learners to develop exploratory search and learning strategies. It should provide tools to support learners to actively (co-) produce contents (not only assignments and documents, but also comments, images, bookmarks etc.)

Therefore, we can conclude that with “web 2.0” instructional design definitely is changing. Our analysis of a typical elearning scenario that follows a “web 2.0” approach demonstrates that instructional design is not dispensable but even becomes more complex. It does not imply a completely new approach but should integrate the various views to instructional design developed in different theoretical traditions. A successful strategy for implementing elearing still relies on a sound and professional concept of instructional design. With this, instructional design will even become more challenging.

References

Banathy, B. H. (1987). Instructional Systems Design. In R. M. Gagné (Ed.), *Instructional technology: Foundations* (pp. 85-112). Hillsdale, NJ: Lawrence Erlbaum Associates.

Braden, R. A. (1996). The case for linear instructional design and development: A commentary on models, challenges, and myths. *Educational Technology, 3*, 5-23.

Dick, W., & Carey, L. M. (1996). *The systematic design of instruction* (4 ed.). New York: Harper Collins.

Frank, H. (1969). Prinzipien der objektivierten Formaldidaktik 'Alskindi'. *Grundlagenstudien aus Kybernetik und Geisteswissenschaft, 10*, 23-28.

Frank, H., & Graf, K. D. (1967). ALZUDI - Beispiel einer formalisierten Didaktik. *Grundlagenstudien aus Kybernetik und Geisteswissenschaft, 8*, 27-34.

Gagné, R. M. (1963). Military training and principles of learning. *American psychologist, 17*, 83-91.

Gagné, R. M. (1985). *The conditions of learning and theory of instruction*. New York: CBS College Publishing.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1988). *Principles of instructional design* (3 ed.). New York: Holt, Rinehart & Winston.

Heimann, P., Schulz, W., & Otto, G. (1965). *Unterricht - Analyse und Planung*. Hannover: Schroedel.

Jonassen, D. H. (1990). Thinking Technology. Chaos in instructional design. *Educational Technology, 30*, 32-34.

Jonassen, D. H., Hannum, W. H., & Tessmer, M. (1989). *Handbook of task analysis procedures*. New York: Preager.

Kemp, J. E. (1985). *The instructional design process*. New York: Harper & Row.

Kerres, M. (2001). *Multimediale und telemediale Lernumgebungen. Konzeption und Entwicklung* (2 ed.). München: R. Oldenbourg.

Merrill, M. D. (1991). Constructivism and instructional design. *Educational Technology, 31 (5)*, 45-53.

Merrill, M. D. (1994). *Instructional design theory*. Englewood Cliffs, NJ: Educational Technology Publications.

Reigeluth, C. (Ed.). (1998). *Instructional-Design Theories and Models. A New Paradigm of Instructional Theory Vol. 2*. Hillsdale: LEA.

Rogers, C. (1961). *On Becoming a Person*. Bostin: Houghton Mifflin.

Schiffman, S. S. (1991). Instructional systems design. Five views of the field. In G. J. Anglin (Ed.), *Instructional technology: Past, present, and future*. Englewood, CO: Libraries Unlimited.

Tennyson, R. D., & Barron, A. E. (Eds.). (1995). *Automating instructional design: Computer-based development and delivery tools (NATO ASI Serie F. 140).* New York: Springer.

Tripp, S. D., & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational technolgy: Research and development, 38,* 31-44.

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