10. Developments in the Design of Instruction

From Simple Models to Complex Electronic Learning Environments

Sanne Dijkstra and Henny Leemkuil

University of Twente, The Netherlands

Abstract: This chapter addresses the relationship between the psychology of cognition and learning and the design of instruction in its development during the last half of the former century and the following years in this century. The findings of research on cognition and learning and the applications for the design of instruction become integrated with the developments in information and communication technologies. The chapter shows both the development of the generic ADDIE model and the design of highly specific situated simulation and games.

Keywords: Adaptive learning; ADDIE model; complex learning environments; instructional design; learning support; simulation-based learning.

The Growth of Information and its Influence on Instructional Design

The ever increasing amount of information and problem-solving procedures and the regular changes of both led and still lead to the question how to pass on the content and sequences of operations to members of future generations in such a way that they can use this as knowledge and skills. That question concerns both the education and training in schools and in other organizations such as governments and industry. Of course, this question is not new and answers have been given in the last three centuries. However the increasing amount and complexity of the information and methods content and the need to pass on much of this to as many human beings as possible, made it necessary to continue the study for answers. That study is part of instructional design (ID), an applied science that became established in the second half of the former century. The study and research on ID led to a substantial body of design knowledge and methods and to many useful instructional programs. The purpose of this chapter is to provide a concise overview of the developments of ID and to show how these developments have
led to rather diverse results: to the general ADDIE model on the one hand to situ-
ated instructional games on the other. This will be explained and illustrated.

The field of Instructional design (ID). The organizations and situations of edu-
cation and training comprise the field of ID. The goals of these organizations are
to pass on the information and problem-solving methods to members of future
generations or to the members of the organizations. ID will at least support these
goals. The design of instruction is the design of the communication between an
expert (teacher) and a novice (student) in such a way that the student will acquire
the knowledge, skills and attitudes that are the goal of the curriculum. Instruction
is any intended activity to make that acquisition possible or easier to accomplish.
The acquisition of knowledge and skills is a psychological process. Instruction
should facilitate that process in the best possible way. The students have to cog-
nize the content of the instructional communication and to practice the procedures
in order to become skilled performers. The result of the design of instruction can
be delivered as an instructional program in printed or electronic format in order to
either be used by individual students for self-study or to be used with all kinds of
help of an expert.

Foundations of Instructional Design

There have been many developments in the design of instruction. The authors
cannot do justice to all developments here. In Europe the concept of didactics is
used. In a recent publication Seel and Dijkstra (2004a) provided an overview of
studies into this concept and its relationship with the concept of ID. Instructional
design started and became established as an applied science in the last half of the
former century. Seel and Dijkstra mention three sources for the development of a
theoretical basis for the design of instruction, which will be shortly outlined in the
next paragraphs. These are (a) the psychology of cognition and learning, (b) the
engineering or systems approach to education, and, (c) the information and com-
monication technology. A fourth source is the epistemology of knowledge acquisi-
tion.

The Psychology of Cognition and Learning and Instructional
Technology

There will be no doubt that learning is a psychological process, though actually
the whole human organism is involved during learning (Dijkstra, 2004a). Before
the 1950s the foundation of instruction in the psychology of learning was often
made, but a direct relationship between the science of learning and an instructional
technology was missing. Skinner (1954, 1958) was the first to state the rules for