

## 1 An Introduction to Learning Design

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### 1.1 Introduction

How can we help people to learn in an effective, efficient, attractive and accessible way? There is no simple, straightforward answer to this question; depending on the specific situation, solution X will work best for person Y. However, it is generally acknowledged that we can improve learning considerably by making the conditions for optimal learning explicit, and then use this knowledge to design new learning events.

Our knowledge of learning design draws on different disciplines. It answers questions such as the following:

- What support do people need in order to learn?
- How can we assess and communicate the results of a learning process?
- How can we make learning and support as effective, efficient, attractive and accessible as possible for everyone involved in the process?

Implicit in these questions are issues related to the nature of knowledge, the nature of learning and the nature of motivation and social exchange. There are several ways to capture learning design knowledge, one of which is the instructional design approach. Here, knowledge is encapsulated in theories consisting of a set of design principles.

Another approach is to identify best practices in teaching and learning, and yet another is to capture the knowledge in pedagogical design patterns. Such patterns take up a position in between theory and best practices in that they are abstracted from best practices.

What a teacher believes about good teaching and learning is influenced by one or more sources. These are: prescriptions taken from instructional design theory; concrete examples of best practices; and patterns of experience. In each case, we will call the representation of this knowledge *learning design knowledge*.

A *learning design* is defined here as the application of learning design knowledge when developing a concrete unit of learning, e.g. a course, a lesson, a curriculum, a learning event. Our assumption is that the quality of a unit of learning depends largely on the quality of the learning design, and, moreover, that every learning practice (e.g. a course) has an underlying learning design that is more generic than the practice itself. This is similar to the belief that every building has an underlying architecture which is more generic than the building itself. The design can be reused over and over again at different times and places for more or less the same course ( or building). This does not necessarily mean that the design is made explicit before it is used. That may well be the case when it comes to the architecture of buildings, but it is not common practice in education. There is (still) no real tradition in education of making formal notations of course designs that can be understood by anyone who is trained to read them.

The lack of a common notation makes designing courses a very local or even individual event. It hampers broader communication about effective educational practice and impedes the evaluation of existing designs. It also makes it difficult to automate some or all of the design and delivery process. A notation would increase the effectiveness of education and training and reduce the overall cost by making it possible to automate the laborious, repetitive parts of the process. In this chapter we introduce the concept of learning design. We examine what a learning designer must know in order to create high-quality learning designs, and we discuss the nature of this knowledge, how it can be modeled in terms of rules, and how the rules are derived. We use several examples to introduce the different modeling concepts. Our informal introduction to many of the concepts used in learning design sets the stage for the rest of this book.

We do not discuss the specifications for a learning design (LD 2003) in any great detail, but we do introduce most of the basic modeling concepts by comparing learning design to a theatre piece and by providing several informal examples of learning design methods or lesson plans. We conclude the chapter by describing the requirements for a learning design notation, which will then be presented in the next chapter.

## 1.2 The Knowledge of the Learning Designer

In this chapter, we use the term 'learning designer' to describe those who have a learning design task to perform. They can be course developers, curriculum developers, teachers, trainers, coaches, mentors or learners who design their own learning plans. A learning designer's basic task is to design a course that meets a set of learning objectives. Say, for example, that a learning designer wishes to develop a course on 'Spanish as a Second Language'. How does the designer proceed? What steps must be taken to develop an effective course? Typically, the designer should seek that give learners a good chance of attaining the learning objectives of the course.

However, the best solution depends heavily on the context of the course. It is possible to develop hundreds of different Spanish courses, one more suitable in situation A, and another in situation B. Solving this problem requires the designer to make use of design knowledge, i.e. a set of rules that can be applied to the design problem. One example of such a rule is: 'When learning a new language, the best approach is to present various common situations - e.g. transacting business in a shop or a hotel - and define different tasks for students to perform in that situation.' A design rule can also take the form of a specific example: 'This particular Spanish course has been used successfully in a comparable situation.' We will answer two basic questions about learning design rules in the following sections: what are they, and how are they derived?

### **1.3 Learning Design Rules: What Are They?**

In the literature much has been written about the nature of learning design knowledge. In this section we will elaborate on the work of Reigeluth (1999, pp 5-30) to specify what learning design rules are. Reigeluth uses learning design knowledge as a synonym for instructional design theory and defines it as knowledge that offers explicit guidance on how better to help people learn and develop. The theory is not descriptive in nature, but prescriptive: it offers guidelines as to what method or methods can be used better to attain a certain learning outcome. Reigeluth states that learning design knowledge is situational rather than universal, meaning that one method may work best in one situation whereas another method works best in a different one. This means that learning design knowledge consists of a set of prescriptive rules with the following basic structure: 'If learning situation S, then use learning design method M.' Furthermore, these rules are not meant to be deterministic, but probabilistic. Applying a rule does not guarantee that we reach the desired outcome, but it does increase the probability that we will. We can expand the rule to reflect this idea: 'If learning situation S, then use learning design method M, with probability P.' It is difficult to indicate the exact probability of design rules for various reasons, and we are usually not able to do so. One reason is that probability is also situation dependent. However, although a rule does not guarantee complete success, the probability of finding a good solution increases when it has been thoroughly tested in practice. The argument is that using learning design rules will probably result in better courses than ad hoc and random decisions about a course design.

Another factor which we have to take into account, and which is also difficult to measure, is that the rules are not value free. People prefer certain learning outcomes and methods above others. There are generally several alternative methods that can be used in a given situation, and in such circumstances in particular, the learning designer has to evaluate the various methods available and choose between them.

Given the discussion above, we can now summarize the structure of a learning design rule as follows:

if learning situation S (*and value V*)  
then use learning design method M (*with probability P*)

As we mentioned above, the segments between brackets in the equation are difficult to measure. We do not intend to discuss these aspects in detail, but will concentrate on the two key factors in the equation: the learning situation and the learning design method.

### 1.3.1 Learning Situation

The left-hand side of the equation is the learning situation. It contains all the factors that are of importance when selecting adequate learning design methods. The situational factors can be seen as the requirements that any new learning design method has to meet, or as descriptors of the situation in which an existing learning design method has been applied. The situational factors can be divided into learning outcomes and learning conditions. Learning outcomes are related to the level of effectiveness, efficiency, attractiveness and accessibility of the learning design method:

1. Effectiveness describes how well the learning objectives have been met by the learning design method. For instance, when a Spanish course is effective, 80% of the students will pass the test; when it is non-effective, only 40% will. Success is measured by the number of students who pass the test.
2. Efficiency describes the labor intensity and cost of the method, both for the learners as they work to attain the outcomes and for the teachers as they attempt to support the learners.
3. Attractiveness describes how much the activities appeal to the learners and teaching staff.
4. Accessibility describes how easily learners and staff can access the learning facilities: are the facilities location dependent or are they accessible remotely; are there time constraints or can learners work whenever they like; can the facilities be adapted to specific situational or personal circumstances; etc. ?

The learning conditions can be categorized as the characteristics of the learning objective, the learners, the setting and the media. A special vocabulary is needed in each category, for example:

1. Learning objective: knowledge, skill, attitude, competence
2. Learner characteristics: pre-knowledge, motivation, situational circumstances
3. Setting characteristics: individual and/or group work, work at school and/or work and/or home
4. Media characteristics: bandwidth, synchronous/asynchronous, linear/interactive, media types.

### 1.3.2 Learning Design Method

The right-hand side of the equation is the key part: the learning design method (or simply 'method'). In this section we explain what a learning design method is and then analyze the overall structure of a method and its underlying components. We will use the script of a play as a metaphor to explain the various issues involved.

#### *The Script as a Metaphor*

A learning design method describes a teaching-learning process, i.e. the process undertaken by persons interacting within a learning environment. To help us model this process, we can look at examples of similar processes and take these as a metaphor for our own. One useful metaphor for learning design is the script of a theatrical play, a film or a game. A script models all kinds of realities in which actors interact with one another within the context of a defined environment (the stage; the scene). Let us look at an example from the script of the play *Street Theater* by *Wilson* (see next page).

If we analyze the structure of the script, we can identify the following components:

1. *Metadata*: the descriptive data that is not a part of the play itself, but identifies the title, author, copyright, objectives, etc.
2. *Roles*: Murfino and Jack are the roles. The roles are played by persons who are referred to as actors. In this example the role is for single persons. There are also roles, like Crowd or Jury, which are performed by a group of actors.
3. *Acts*: this play has two acts (only a fragment of the first act is quoted). The curtains usually close between acts to allow the stage crew to set up new scenery or to give the actors a break. Acts are sequential; one follows the other.

Doric Wilson's

## STREET THEATER

Stonewall1969

in two acts

Roles for this fragment:

-MURFINO, a thug

-JACK, heavy leather, keys left

### ACT ONE

(No curtain. No scenery. The audience, arriving, sees an empty performance space in half light. The sound system plays a medley of up beat golden oldies from the late sixties, ending with the Lovin' Spoonful's *Summer in the City*. MURFINO, a thug, enters through the audience carrying a battered garbage can. )

MURFINO: (To the audience, an unauthorized prologue.) Hot enough for you? They say we got another week of heat wave. (As he wipes his brow.) This play is all about this bunch of lowlifes. Juicebums, hopheads, weirdos, oddballs, queers-what you call your "artistic element." The usual gutter crud you got to expect to contend with down here in Greenwich Village.

(The stage lights come up as MURFINO places the garbage can downstage left. JACK, heavy leather, keys left, enters left, carrying an overly full plastic trash bag. The ominous image used to promote S&M establishments, JACK 's geniality and good humor comes as a surprise to the uninitiated.)

JACK: (Giving the bag to MURFINO.) Here you go, Murfino.

MURFINO: (Investigating the bag ) What's this?

JACK: you forgot your lunch.

MURFINO: Garbage! (Emptying a wide assortment of rubbish into the garbage can, filling it to overflowing.) We gotta be this authentic?

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4. The set-up of the stage *environment*: the descriptions between brackets provide information about the set-up: the staging (music, no scenery), the props (garbage can, trash bag), and which actor is on the stage at what time.

5. *Role-part*: the following describes a role-part: 'MURFINO: (Investigating the bag.) What's this?'

A role-part describes the activities of an actor when it is his or her turn on stage

6. *Sequence of activities*: the sequence of activities is specified in two ways. The order of the text lines suggests the order in time. However, when different activities are performed simultaneously ( e.g. a crowd shouts while two knights are jousting), this is usually explained in the text between brackets.

7. *Conditions*: these are special comments between brackets that tell the actors how to adapt to specific situations. These are not shown in the fragment presented above, but an example would be: (if the audience laughs, tell them ...; otherwise say ...). Such constructs are generally found more in game scripts and other interactive scripts than in linear media formats such as plays and film.

In addition to these structural aspects, we can identify other important factors in our script metaphor. One is the specificity of the script: it can be very strict and detailed or more open to improvisation during performance. Specificity, in turn, is related to another factor, which is that the script of the play is different from the performance of the play itself. The script is a model of the play. It is a high-level description that focuses on some details but abstracts from others. The same script can be staged by many different theatre companies at many different locations, with different actors and for different audiences. It can be repeated over and over again, but the actual performance ( a 'run' in computer terms) can be very different and have certain unique aspects to it. As a result, a script has to be instantiated and interpreted at different moments in time to create an actual play.

Another factor is that the scripting language has a particular format (roles, acts, etc.), but it does not require that the play be of any specific type (e.g. a comedy or a drama). In fact, all sorts of realities or fantasies can be modeled in a play or film. The medium puts constraints on what can be modeled, e.g. some things are possible in film that are not possible in the theatre, but these constraints only impact the quality of the representation, not its essence.

Finally, it is important to note that scripts are generally written by a specialist who is not necessarily the director or one of the actors.

### *Structuring Learning Design Methods as a Script*

We can use the metaphor of a script to model learning design methods. Learning design methods have different names, one of which is 'lesson plan'. A search on the Internet reveals several sites with example lesson plans (see Van Es (2004) for a list). Let us look at a lesson plan for a Spanish course (Masciarelli 2004).

*Title:* Beginning of the Year or Semester Review for returning students

*Primary Subject:* Language Arts -Spanish; Grade Level -6-8

*General Goal:* Student will be able to converse with peer in target language as a way of reviewing previously learned material.

*Required Materials:*

- Textbook (Ven Conmigo)
- Lined Paper
- Name sticks (for random pairing)

*Anticipatory Set (Lead-In):*

Show scene from accompanying video series that models student conversation.

Discuss how at the end of the course last year, all students were able to converse like this.

*Step-By-Step Procedures:*

1. Students should be assigned partners by random pairing of name sticks.
2. Students should begin by reviewing key phrases and verbs. They should do this in pairs using a read and quiz method.
3. To reinforce the review, students should write an outline of what they'd like to say in their conversation, either as homework or in the next class. When students have completed their outline, they should create a realistic conversation.
4. After they have completed their conversation, the students should check with the teacher before memorizing the dialogue. Any mistakes should be brought to the students' attention. Once correct, memorization and practice should begin.
5. Once memorized, the conversation should be performed before the class.

Closure (Reflect Anticipatory Set): If lessons are videotaped, students may watch their videos and compare them to the series that accompanies the hook.

Assessment Based On Objectives: Students may be graded using a rubric based on objectives or be given narrative feedback. Students could also use their own videos as a self-assessment tool.

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We can model this lesson plan as a kind of play. The metadata is the title, author, learning objective (general goal). The roles are implicit: teacher and students. The script is told from the teacher's point of view. As no explicit acts are mentioned we can model it as a one-act play, but the grouping of activities suggests four acts (anticipatory set, step-by-step procedures, closure and assessment). The set-up of the learning environment is not described in detail, but a classroom context is implied. The role-part can be distilled from the text, for example:

Teacher: Show scene from accompanying video series. ..

Teacher: Assign students in random pairs, using name sticks...

Student: Review key phrases and verbs...

Note that the role-part is described using the structure 'Role: Activity'. The sequence is indicated by the text, as in a script. Some conditions are mentioned: 'if lessons are videotaped, ...'; 'when students have completed their outline'. Taking the script as our metaphor, we could rewrite the lesson plan as follows (in abridged form):

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## LEARNING DESIGN METHOD

### Metadata:

*Title:* Beginning of the Year or Semester Review for returning students

*Primary Subject:* Language Arts, Spanish;

*Students:* Grade Level -6-8

*Setting:* classroom, students grouped in pairs

*Learning Objectives:* Student will be able to...

### Play

*Act I: (Anticipatory Set):*

Teacher: Show scene from accompanying video series...(video set)

*Act II: (Step-by-step procedure):*

Sequence:

1. Teacher: Assign students in random pairs, using name sticks. .. (name sticks)

2. Student: Review key phrases and verbs. ... (Ven Conmigo)

3. etc.

*Act III: (Closure)*

Teacher: Grade students (score system) OR

Student: Use video to carry out self-assessment (video)

### Conditions:

IF conversation is complete THEN students check with the teacher before memorizing.

IF teacher wants to grade THEN students do not carry out self-assessment. Etc.

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Look at how the activities in the example are structured. Every activity implies certain resources that are needed to perform it, e.g. a classroom, name sticks or a book. To put it more generally: roles perform activities within an environment (e.g. classroom, stage, home). The environment is filled with resources (e.g. books, computers) that can be used. Every activity is closely related to the environment needed to perform the activity.

When analyzing the sentence that describes the activity, we get an idea of the resources needed in the environment. Take the sentence 'students may watch their videos and compare them to the series that accompanies the book'. The verbs in the sentence (watch, compare) describe the behavior students are expected to undertake. The nouns in the sentence define the resources that are needed (their videos, the series that accompanies the book). Besides these nouns, implicit resources may also be needed to perform the activity, e.g. the video player, a classroom. In the example above, we summed up the resources between brackets.

### **Method Components**

Methods are not fixed in terms of number of components; they can be broken down into smaller methods or constituent parts. In the example above, the different acts can all be seen as smaller methods that can be reused in other contexts. The method used in the Spanish course can also be incorporated into a larger course or curriculum. This raises several intriguing questions: can we develop new methods from existing smaller ones, and what is the smallest workable, reusable unit for developing methods? The subject of reusing smaller learning objects (figures, computer programs and textbooks) is a popular one in the literature (see e.g. Littlejohn 2003). It is important to reuse learning objects, but we must bear in mind that they are not courses; they are the resources needed to perform learning activities. Reusing a learning resource in a new course still requires us to integrate the object into the course activities and method. So the exchange of learning resources can be seen as one level of reuse in education and training. Another option is to reuse learning design methods or parts of such methods. It is too early to say how far a learning design method can be broken down and what the smallest constituent part is; it may be a 'play', an 'act' or an 'activity'. We assume that all three can be exchanged to develop new courses.

### **Summary**

In the previous sections, we analyzed the structure of learning design rules. The formula takes the following format:

#### *If* Learning Situation:

Required level of effectiveness, efficiency, attractiveness, accessibility AND  
Characteristics of learning objectives, learners, setting, media AND  
Values of Learning Designer

#### *then* Learning Design Method:

A Play of one or more sequential Acts with one or more parallel Role-parts, Taking into account a set of conditions for the Play, the Act or the Role-part

*with* A certain probability of success

## 1.4 Learning Design Rules: How Are They Derived?

Now that we know how a learning design rule is structured, we can answer the next question: how can we create rules that work, i.e. rules that offer a high probability that learners will indeed attain the intended learning outcomes? There are two aspects to this question: the particulars of the situation or situations in which the rule is used and its success within that specific context. The lesson plan for the course Spanish as a Second Language tells us the learning design method, for example, but we know very little about the situation in which it was used, and have no idea whether the method was successful. We need more information if we want to assess how good the rule is. For example, it would be nice to know the effectiveness of the method (percentage of students with a sufficiently high mark), or its efficiency. (How much time did it take to refresh the students, knowledge of Spanish in this way? Wouldn't other methods have been easier?) We also need more information about the underlying values or preferences of the method's designer. Did he or she include collaborative aspects because they have been shown to be more effective, efficient or attractive than other methods, or because he or she values these types of activities more than, for instance, individual work?

There are three categories of good rules: (1) those derived from instructional design theory, (2) those derived from best practices, and (3) those derived from patterns in best practices. We will refer to first type of rule as prescriptions, the second as examples and the third as patterns. The relationships and differences between the three categories are quite complex. For example, instructional design theory can be based on a rigorously empirical approach, which results in approximately the same procedures as the patterns approach. Moreover, patterns can be abstracted to such an extent that the relationship between practice and pattern is lost.

We will now discuss the three types of rules briefly. We do not prefer one over another, but believe that all three are complementary.

### 1.4.1 Rules Derived from Theory

The romantic idea behind any theory is that it reveals an unconditional truth. When we apply this idea to learning design theory, it means that the theory would search for a learning method that can be applied universally: in every course, in every setting and for every person. To put it differently, the If side of the equation would be empty; there would be only one recommended learning design method. A recent example is the approach taken by Merrill (2003). He proposes some 'first principles of instruction', stating that 'the most effective learning products or environments are those that are problem centered and involve the student in four distinct phases of learning:

- (1) activation of prior experience,
- (2) demonstration of skill,
- (3) application of skill, and
- (4) integration of these skills into real-world activities'.

He doesn't make this statement conditional on any particular situation: his principles are the minimum requirements for every learning product.

Leaving aside whether these principles are indeed unconditional, we do know that they are based on a review of recent research into instructional design and that using them to develop a learning design method will probably increase the effectiveness of that method. However, let us return to our wish to design a Spanish course. Do these principles provide us with enough guidelines actually to design the course? The answer is no. The principles can be used to check whether an existing design meets the requirements, but they are not practical enough for a course developer (although they can be inspiring). Course developers want more detail, perhaps even complete examples of real practice.

Besides these universal principles, we also come across conditional instructional design principles in the literature, although they tend to be hard to find for a learning designer, and sometimes contradict one another or are hard to combine. It would be useful to have a summary of current, state-of-the-art instructional design principles, using a uniform rule format such as the one presented in this book, and similar to the attempt made by Reigeluth (1999). It would provide some dozens of models and summarize them in a conditional format (If situation then use this method). One example is the rule for designing constructivist learning (abridged; Mayer 1999, see next page).

The prescriptive rule is conditional, but it still has a high level of abstraction. It can be used to explore a wide range of design problems, but it does not provide specific guidelines for the designers of our Spanish course, for example.

#### Desired outcomes and conditions

Foster knowledge construction through direct instruction. Primarily intended for textbook-based learning, lectures and multimedia environments in which behavioral activity is not possible.

#### Values

- focus on process and product of learning
- focus on knowledge transfer and retention
- focus on how to learn as well as what to learn

#### Major Methods

##### *1. Select relevant information*

- highlight the most important information for the learner (using headings, italics, etc.)
- use instructional objectives and/or adjunct questions
- provide a summary
- eliminate irrelevant information; be concise

##### *2. Organize information for the learner*

- structure the text in some defined formats ( cause-effect structure, generalization structure, enumeration structure, classification structure or comparison/contrast structure)
- Outlines
- Headings
- Pointers or signal words
- Graphic representations

##### *3. Integrate information*

- advanced organizers
  - illustrations with captions
  - animations with narration
  - detailed examples
  - detailed questions
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#### 1.4.2 Rules Derived from Best Practice

Another way of deriving learning design rules is to take the learning design method used in a specific example course. In this approach, our search for a learning design method ends not with a principle but with a comprehensive example. We can use several tactics to do so. The first is to set up a database of accessible and usable courses or course components (e.g. Edusource 2004; Merlot 2004), i.e. 'out-of-the-box'. The second tactic is to set up a database of learning design methods, e.g. course scripts, frameworks or lesson plans. The 'Spanish as a Second Language' lesson plan is an example. Lesson plans are more abstract than actual courses and can be used as specific guidelines for designing a new course. However, unlike in the first example, the course has yet to be developed.

One major problem with all such collections of examples is that the situational characteristics of the courses and lesson plans must be described in enough detail to support a successful search process. They must also provide an indication of the quality, and the resulting learning design method must be available in a usable format if it is to be of any practical use. Quality can be expressed by the probability of success; other methods are peer review, expert review or the average quality ratings of users.

Unlike with rules derived from theory, when rules are derived from best practice the resulting learning design method is very well defined -an advantage that also has its disadvantages. The chance of finding a successful example that matches precisely is not very great. It would take a huge number of courses and lesson plans to have a reasonable chance of identifying a suitable solution. In other words: whereas the theoretical approach is intended to be of general purpose because it excludes conditions as much as possible, the example-based approach is so highly contingent on conditions that the chance of finding a matching example is relatively small. However, it may be worth a try. Things have changed now that the Internet allows us to share course examples and lesson plans with others on a massive scale. A search on the Internet revealed at least 93,901 lesson plans in 16 different databases (see Van Es 2004). Some of these contained a large number of lesson plans (more than 35,000), while others were too small to be of any real use (fewer than 1000, some even fewer than 100). Learning designers are advised to try first try to find existing examples on one of the websites identified by Van Es. Other approaches, e.g. that of theoretical prescriptions, are preferable only when no matching examples can be found.

#### **1.4.3 Rules Derived from Patterns in Best Practice**

The third, rather new and promising approach is to analyze patterns in collections of comparable best practices, instead of using just one comprehensive example. Patterns reflect the experience of experts in the field, are described concisely and solve recurrent problems in a learning design. Patterns can be created in two ways: inductively, by analyzing common structures in a set of learning design methods, or deductively, by having meetings with experienced learning designers to identify recurrent problems and generic models for solutions. The second approach is the more popular one at the moment (e.g. Bergin et al. 2000; E-LEN 2004). The following is an example of a pedagogical pattern ( abridged; Eckstein 2000):

## LEARNING TO TEACH AND LEARNING TO LEARN: RUNNING A COURSE

*Problem: how to start a course?*

Forces: you want to get to know the participants; want to break the ice; ...

Solution: the participants introduce themselves in a way which at the same time provides an introduction to the topic (different variants are provided).

Discussion: for participants who seem to be aggressive, choose variant ..

*Problem: how can you make students less dependent on the teacher?*

Forces: it's easy for students to ask the teacher, but in a work environment the teacher will not be available

Solution: assign a problem to your students. When they have a problem ask them to search for answers with their peers first.

Discussion: a group often has different skills ..  
etc.

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The rule expressed in the example takes the format: ' if problem situation, then solution' . This is similar to our approach. The problem is a wide- spread one in education. The solution is expressed in informal terms. This is fine for human readers, but will be difficult to support when computers are brought in. The different pedagogical patterns that can currently be found on the Internet all define their own pattern language. To allow us to search, store, adapt and use patterns, we need to adopt a single, standard notation. For example, taking the script modeling language presented above, we could develop a pattern of a learning design rule as follows:

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Situation:

- Train a skill
- Setting: individual student

Method:

- |      |          |  |
|------|----------|--|
| Play | Act I:   | Student: read/study introductory information   |
|      | Act II:  | (repeat for n exercises)<br>Student: do exercise (1..n)<br>Student: if question, then ask other student or tutor<br>Student: answer questions posed by by fellow students<br>Tutor: if fellow students cannot respond, then answer students; questions |
|      | Act III: | Tutor or Agent: Provide feedback about learning outcome  |
-

A pattern such as above could be used as a learning design template for many skill-learning situations. The pattern can be derived from existing examples by abstracting the learning design methods, mainly by looking at common patterns.

Patterns can also be combined. For instance, the pattern above does not describe how to prepare the introductory information or tests. This usually means that they are available in the design and are fixed. In many situations, the tutor prefers to control this information so that he or she can develop or adapt it. A pattern for texts and tests may take the following form:

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Situation:

- Develop / adapt introductory information (or tests)

Method:

Play Act I: Tutor: develop / adapt introductory information ( or tests)

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The methods can be combined to form the following pattern:

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Situation:

- Train a skill
- Develop / adapt introductory information
- Develop / adapt tests
- Setting: individual student

Method:

Play	Act I:	Tutor: develop/adapt introductory information
	Act II:	Tutor: develop/adapt test
	Act III:	Student: read/study introductory information
	Act IV:	(repeat for n exercises) Student: do exercise (1..n) Student: if question, then ask other student or tutor Student: answer question posed by fellow student Tutor: if fellow students cannot respond, then answer students' questions Student: take test and get feedback about test results
	Act V:	Tutor or Agent: provide feedback about learning outcome

The main point here is not how correct the example is, but how to notate the patterns and the idea of composing learning design methods based on smaller pattern components.

The notation can be easily translated into a more formal notation, such as that provided by Learning Design (LD 2003), as we will see later in this book. These examples also give an initial indication of the level at which the learning designs are being reused, i.e. at the level of short plays that can be combined to form longer ones. This would suggest that we should identify practical, small-scale, independent play structures with a recurrent objective (as expressed in the situation) as the building blocks for learning design methods.

It would be useful for authors to have access not only to the patterns, but also to the specific examples derived from them, preferably notated in Learning Design so that they can be adapted and reused.

### 1.5 Conclusion

A learning designer uses learning design knowledge to create the learning design method for a course. Learning design knowledge consists of a series of rules taking the *'if situation, then method'* format. These rules are derived from theory, from examples, or from patterns. To enable learning designers to search for, share and reuse learning design methods, a standard notation must be available and used.

In this chapter several design requirements have been mentioned throughout the text. To conclude this chapter we will state the requirements for a learning design notation:

1. The notation must be comprehensive. It must describe the teaching-learning activities of a course in detail and include references to the learning objects and services needed to perform the activities. This means describing:

- How the activities of both the learners and the staff roles are integrated.
- How the resources ( objects and services) used during learning are integrated.
- How both single and multiple user models of learning are supported.

2. The notation must support mixed mode (blended learning) as well as pure online learning.

3. The notation must be sufficiently flexible to describe learning designs based on all kinds of theories; it must avoid biasing designs towards any specific pedagogical approach.

4. The notation must be able to describe conditions within a learning design that can be used to tailor the learning design to suit specific persons or specific circumstances.

5. The notation must make it possible to identify, isolate, de-contextualize and exchange useful parts of a learning design ( e.g. a pattern) so as to stimulate their reuse in other contexts.
6. The notation must be standardized and in line with other standard notations.
7. The notation must provide a formal language for learning designs that can be processed automatically.
8. The specification must enable a learning design to be abstracted in such a way that repeated execution, in different settings and with different persons, is possible.

These requirements provided the basis for the Educational Modeling Language (EML 2000; Koper 2001; Koper and Manderveld, 2004), and the later standardized version of EML, called Learning Design (Koper and Olivier 2004; Hummel et al. 2004; LD 2003). Koper and Olivier (2004) provide a first qualitative evaluation to what extent these requirements are met by the LD specification. They conclude that the specification fits the requirements well, however further research is needed to a) evaluate how well LD meets the pedagogical expressiveness requirement, b) integrate the Question and Test Interoperability (Q TI 2003) specification into LD (this has since been done through an update of the Q TI specification by IMS), and c) the personalization rules aspects have to be studied in more detail. The following chapter examines the LD specification in more detail.