Learnability

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INTRODUCTION

Learnability is not exactly a new concept in information technology, nor in cognitive science. Learnability has been a key concept of usability (Folmer & Bosch, 2004) in the area of software system design, where it relates to such issues as consistency, familiarity and simplicity. It has also been a traditional concept in linguistics in relation to the ease of language learning (McCarthy, 2001) and in machine learning (Valiant, 2000).

The concept of learnability has recently been repurposed within the field of instructional technology (Duchastel, 2003), building on the concept of usability in Web site design (Nielsen, 2000), and it is that learnability that is considered here. Learnability in this new sense concerns how learnable some piece of instruction is. It deals with a facet of educational resources.

The basic question is this: What makes the content of an instructional site (or of some resource) learnable? Take any one of the many thousands of online learning courses currently available on the Web and ask yourself: Does this course seem difficult to learn (assuming you have the proper background for it)? What would improve it? What would the ideal online course in this area look like? These questions all underlie the learnability of the course.

What then is learnability? Could we say that it is defined by successful learning? That would mean that students who study the course thoroughly learn its content, as evidenced on a good test for instance. Or could we say that a main criterion is ease of learning? Meaning that students experience good intellectual flow and enjoy the course.

Both of these factors, success in learning and enjoyment of learning, can be considered criteria of learnability. Are there others? That is the issue of learnability.

The skeptic will immediately insist that learning takes place within a learner and that it is that locus that mainly determines learnability – that is, the curiosity, intelligence, motivation and persistence of the learner. These are what make or break learning. The teaching materials can only go so far, the learner has to make a go of it, make it succeed.

While there is some truth to that view, it is certainly not the full picture, nor the most useful picture. Consider traditional usability in Web sites or software products. There too, the user plays a role. If he is dull-witted, or perhaps too pressed for time (showing a lack of interest), or just resistant to learning the basics (jumping in and thrashing around – as often happens), there is little scope for success no matter how usable the site or program may have been made. But we do not give up on usability in Web site creation because of that.

The point is designers do not blame the user for incompetence, for ill-will or for the lack of success of their site or program. They maximize usability, realizing well enough that usability is certainly contextual. The same applies, as it should, to learnability: success in learning can be maximized through the product, over and beyond context issues, or in spite of them.

The product view of instruction is an important one, one that is emphasized here. An alternate view, much more widespread, is a process one: learning is a process, and so is instruction in the sense of manipulating the situation so as to facilitate learning. This is why the immense amount of research on learning and education over the past century has not dealt explicitly with learnability.

The process view is not to be denigrated, but a product view can incorporate processes and has definite design advantages. Learnability is best considered in this light.

LEADING QUESTIONS

The challenge before us is to identify those features of excellent learning materials. What makes something learnable? Very learnable, most learnable?

But first, why is it so difficult to pinpoint these features? What are the deep issues underlying learnability? There are three of them we need to consider. They are learning, design, and curriculum. Each is difficult in its own right and learnability involves considering them jointly – hence the magnitude of the challenge.

The first deep question is what is learning? The field of learning has long been a core issue in psychology and numerous theories of learning have been put forth in answer (Kearsley, 2004). The issue is far from settled, as practitioners such as educators well know. There is acknowledgment of different kinds of learning, with different factors at play, but no large agreement on these or on the overall picture.

The second deep question concerns teaching. How do you design for learning? There are general principles that have evolved over time, codified broadly in what is known as the field of instructional design (Reigeluth, 1999). But

here too, there is hardly agreement. All design theorists will subscribe to general systems principles like those found in software design or in HCI. All subscribe to the value of usability testing, the trying out of the materials designed with sample students in order to verify the strength of the design and capture any ways of improvement. But given divergences in views of learning, it is natural that hard disagreements will occur here too, in how to design for learning.

The third deep question concerns what to teach - the content. That was what led educators to determine and discuss taxonomies of learning objectives half a century ago (Bloom, 1956) and why this issue remains at the heart of much debate in education (Egan, 1997).

At first thought, you might think that this is an outside issue. That first, we decide what to teach, then only after that, how to teach it, how to design it. Or we might think that teachers and curriculum specialists, or professors and institutions, determine the content "to be covered". That learnability applies to any content, whatever it is determined it should be. But that overlooks the crucial notion that the *what* and the *how* of learning are inextricably linked (Carroll, 1990), just as in communication more generally. An instructional designer must fashion the content as much as the process, in the same way an information designer fashions information well beyond the graphic design aspect. Both are information architects, but that is not yet widely recognized, which creates difficulties for the acceptance of learnability.

In the next sections, I will address these leading questions by introducing some simple models that synthesize them in a nutshell. This remains a very cursory look at the issues, but nevertheless shows the direction in which they can be further explored, as is done in Duchastel (2003).

LEARNING - THE CIM MODEL

At its most general, learning is the process of internalizing information in memory, making that information available later on when needed. But learning the names of the bones in the body and learning the principles of acoustics are rather different forms of learning. We learn them in different ways. What are the commonalties? What are the differences?

There are three types of learning, conveniently contrasted in what we can call the CIM model. CIM stands for Comprehension, Interest, Memorizing, these being the three factors involved in the learning process.

Comprehension is based on our ability to reason, to fit things together, to see how they all work together. Comprehension is the process of generating internal models of the world in all its workings, large and small. We comprehend when we see how things fit together, how it all makes sense. Understanding is a process of rational model building.

Interest, the second element in CIM, is the attentional factor in learning. If something stands out from its context, it will be more easily remembered, as will things that are extremely vivid or of great personal importance. More often, we try to learn things that are only of mild interest and then, if attention wanders, learning suffers. Interest has the function of keeping us on task.

The third element, memorizing, handles things that do not fit well together, that have no basis in rationality. For instance, the name "cochlea" to represent one of the components of the ear is quite arbitrary to us – there is no reason for it [no reason that we know]. It is [to us] purely arbitrary and no amount of reasoning will assist in "understanding" it. We just have to associate the name and the component.

DESIGN - THE MOCAF MODEL

Based on the CIM model, we can see that there will be three types of elements that are needed within an instructional product: models, cases and facts. Combining these (and any product would have all three) leads to the acronym MoCaF for the design model appropriate for the creation of highly learnable instructional products.

Models are the tools of understanding; they are what lead to comprehension. Cases are the illustrative materials that instantiate the models in particular settings. They are the main means of grabbing and holding attention. As for facts, they are just the basics that need to be brutely memorized.

Models are what drive comprehension. The aim of design in this area is to create models that embody the disparate elements of content while synthesizing them in an artifact [the model] that clearly communicates and is easily learned. Models show how elements relate to one another; they capture relationships and interactions.

The craft of developing models is one of establishing the underlying structures in a field [content expertise is essential here] and of then representing those structures in synthetic form that facilitate communication and understanding (Wurman, 2000).

Cases are the illustrative material in instructional content. They embody the living problems and the living application of the models. They range from simple examples to complex case studies. Of particular interest are those relatively complex cases that mirror difficult real-life settings, such as those used in problem-based medical education or in business education.

Cases are multi-functional in an instructional application. At least three functions can be served:

1. To illustrate the content of a model, instantiating it and situating it in real life.
2. To provide practice to the student in applying knowledge.