Structural Learning Theory

General

Structural learning theory is one of the cognitivist perspectives on instructional design proposed by Joseph Scandura in 1970s. Scandura's theory suggests human **knowledge is** consisted of **rules** which are to be learned. Those rules are determined by parameters of **domain**, **procedure**, and **range**.

What is structural learning theory?

Structural learning theory suggests that structures (problems) that a learner must learn, need to be formed as **rules** performed on a **domain**.

A domain here is defined as a set of characterizing **inputs** and **outputs**. Inputs and outputs can be anything, even a process, an idea or a concept. For example:

- list of verbs (input) → present participles (output).

Operations performed on given inputs are called rules, and they generate unique outputs. Rules can contain different levels of abstraction and are always defined with three parameters:

- **domain** - its allowed **inputs**,
- **range** - its expected outputs, and
- **procedure** - the sequence of **operations** to perform **on the inputs**.

For example: a rule *form present participle* has the domain of all English verbs, the range of present participles and the procedure of adding “-ing” ending to the verb.

Rules can be simplified into **lower-order rules** (*atomic components*) which represent most basic concepts learner needs to know when dealing with a problem from given domain. By combining these atomic components and application of more complicated to lower order rules new **higher-order rules** are derived. Higher-order rules are rules which can have other rules as inputs or outputs (for example mathematical theorems) and they can be used to solve complex problems in the whole domain.

Structural learning theory further attempts to identify components crucial for solving the given problem and is based on the procedure called *structural analysis*. Structural analysis is performed in the following steps:

1. The first step is to identify problem domain inputs and outputs, or even only outputs (representative problems).
2. One or more solution rules should be defined for the domain (for each problem). Problem domain can be both well- and ill-defined[1)]. In case of an ill-defined domain, it should be divided into well-defined sub-domains which can generate at least one solution rule.
3. Convert each solution rule into a new problem whose solution is that very rule

Domain definition is followed by **construction of hierarchy of rules** for well-defined domains. Rules should be explained on prototype problems, but can also leave some **gaps** in problem solving procedure, which **are then converted into higher-order problems** containing gap rules. Higher-order rules are then used to fill the gap, but can also validate lower level rules.

An important part of the theory is also **prior knowledge (rules)** of the learner, that will **enable construction of new rules**. This knowledge can be examined by instructor, that can be both human or artificial.

Structural learning theory's applications have been made in **mathematics** and **language learning**.

What is the practical meaning of structural learning theory?

Criticisms

Keywords and most important names

Bibliography

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1)
An ill-defined domain is one in which rules are quite simple, yet there is no direct complete solution like chess, or poetry writing.