Strategies for problem-solving Instruction

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Type of learning outcome

Expert: someone who can apply knowledge to solve problems

Problem solving: the ability to combine previously learned principles, procedures, declarative knowledge and cognitive strategies in a unique way within a domain of content to solve previously unencountered problems

Key ingredient

Knowledge within a domain, particularly knowledge of relational and procedural rules and how these principles relate to each other

Types regarding its solution

Heuristic: when no clear procedural rule exists

Algorithmic: when an application of a specific procedural rule applies

Types regarding its complexity

Simple: when fewer principles must be considered

Complex: when the clarity of the problem is fuzzier

Types regarding its clarity

Well defined: problem in which situations given and goal states are clear. Can have a single or finite, definable range of solutions

Ill defined: problem in which situations given and gal states are unknown, vague, or extremely situation-dependent are termed. Can have multiple, correct solutions with the appropriateness of the solution dependent upon the rationale for solution

Cognitive processing

Knowledge representation → Solution planning → Solution implementation → Solution evaluation

Micro strategies

Alternate ways of representing the problem: graphic, analogy, etc.

Ways of limiting the number of alternative approaches

Hints at the general form of the solution or sub solutions

Micro strategies contd.

Searching strategies for retrieving relevant information

Monitoring techniques for appraising the appropriateness of the solution

Mental imagery tactics for recognizing problem types or solution types

Methods for providing external storage, such as job aids or graphics

Generic strategies such as hypothesis and test, working forward, working backward, and means-ends

Specific strategies for representing problems or retrieving solutions for the particular domain

Worked examples

Completion task

Macro strategies

Socratic dialogue: to guide student to attainment of derived learning through interaction with an expert or mentor whose role is to provide instances and guiding questions

Expert systems: computer-based programs which, when given data, are able to solve problems within a limited domain of expertise

Sequenced problem sets: the presentation of carefully sequenced problem sets

Simulations: an activity that attempts to mimic the most essential features of a reality but allows learners to make decisions within this reality without actually suffering the consequences of their decisions

Microworlds: similar to simulation, except that that the central idea is a learner centered construction

Anchored instruction: focuses primarily on the learning of domain specific problem solving based on situated cognition

Case studies and case problems: present a realistic situation and require the learners to respond as if they were the person who must solve a problem

Problem- based learning: approach of instruction that structures courses and entire curricula on problems rather than subject content

Cognitive apprenticeships: involves a learner working under the supervision of an expert or master to learn the skills of a trade, particularly procedures and motor skills

Others: for example Schuman's inquiry training and the Biological Sciences curriculum

Smith, P.L. & Ragan, T.J. (2005). Instructional Design. Third Edition. Willey Jossey-Bass Education. Chapter 12