Doug Kueker
EDCI 674, Fall 2007

Flexibly Adaptive Instructional Designs – The STAR Legacy Shell
John D. Bransford, Vanderbilt University

Major Contributions

Theory and Approach is Responsive to Local Needs – This particular design theory, as noted by the authors, "falls midway between two extremes on a continuum that represents the amount of guidance provided to instructors or to students" (p.188). The notion of flexibly adaptive design, more than other theories discussed, places key decisions regarding the design of instruction in the hands of teachers and students.
Explores the Interface Between Learning Theory and Technology – This approach balances flexibility in local implementation with scalability of tried and true learning principles through the use of a technological "shell" that can be manipulated within certain parameters. This is a unique aspect in that it truly embeds what is "known" to be effective for learning within a design that allows for maximum flexibility in its application.

Applying the Theory

Make the Learning Cycle Explicit – Creating a visual anchor (i.e. the STAR Legacy Cycle) becomes important when designing a flexible and iterative learning environment. The visual anchor serves as a guide for learners and teachers.
Enact and Transform Prior Knowledge – When designing within the shell it is important that the IDer is explicit in providing multiple opportunities to both make prior knowledge explicit and then challenge pre-existing conceptions. "Look ahead," "research & revise," "generate ideas," and "multiple perspectives" are elements that afford these opportunities.
Developing a Rich Conceptual Framework – When designing elements to include in the "shell" it is important to consider how to explicitly engage students in deepening their conceptual model by encouraging multiple iterations of the existing mental model they have for the problem and related topics under study. Three examples to explicitly do this are:

- ✓ Including multiple "challenges" at varied degrees of difficulty
- ✓ Structuring multiple perspectives to "meet students where they are at" and expand from there
- ✓ Providing numerous analog and dynamic opportunities for the learner to test his or her mettle with the topic

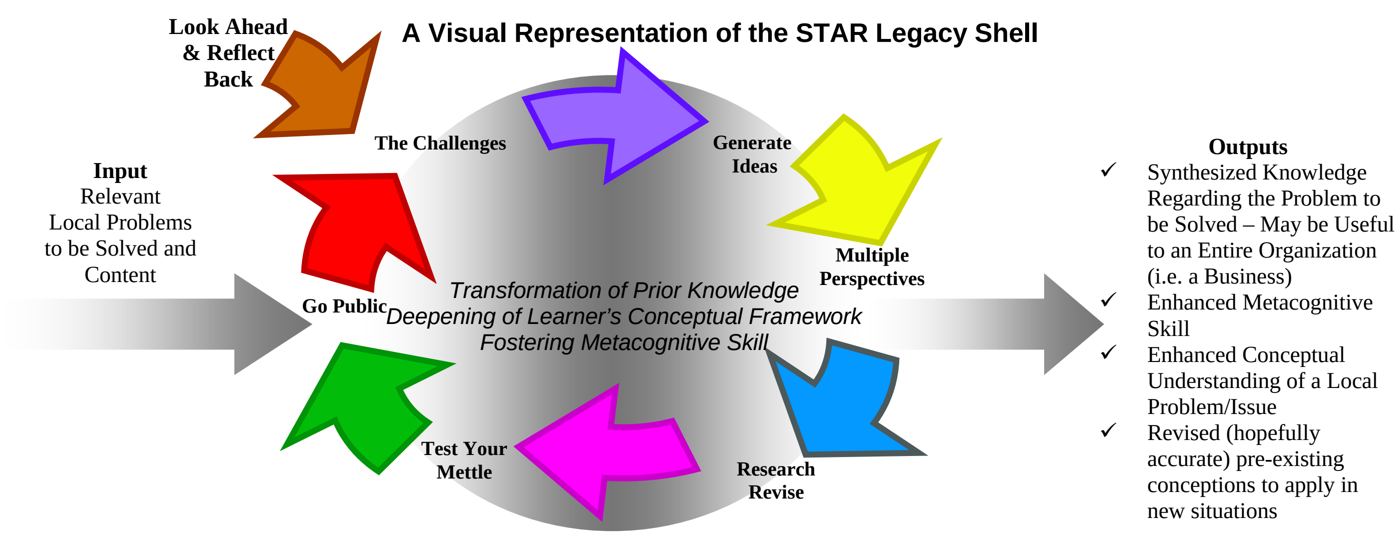
Fostering Metacognitive Processes in Learning – To explicitly foster metacognitive processes the IDer may:

- ✓ Provide strategic and conceptual scaffolds during "generate ideas" and while completing entries in the notebook
- ✓ Provide conceptual or metacognitive scaffolds during "multiple perspectives" that encourage students to compare, contrast and draw distinctions between the perspective presented and his or her current mental model
- ✓ Provide prompts during "reflect back" that engage a metacognitive reflection prior to moving to the next challenge

Add Value to the STAR Legacy Shell by Drawing Upon Other Design Theories – For example…,

- ✓ **Mayer –**Structure instructional messages provided during "Multiple Perspectives" with the SOI model in mind.
- ✓ **Hannafin** – Use criteria from the three types of enabling contexts as you structure each challenge (i.e. move from externally imposed to individually generated challenges). Draw upon the various tools, resources, and scaffolds outlined as components of an OLE when structuring any of the elements in the STAR Legacy shell.
- ✓ **Schank –** Use the structure outlined for Goal-Based Scenarios when authoring the challenges. Utilize the notions about storytelling in structuring "Multiple Perspectives" and coaching learners as they "Test their Mettle."
- ✓ **Perkins & Unger –** Use criteria outlined for Generative Topics when identifying "topics" to be addressed in each of the challenges (especially the initial shared challenge). Utilize criteria outlined in "Understanding Performances" to structure the "test your mettle" element.
- ✓ **Gardner -** Offer opportunities that appeal to a variety of intellectual strengths as students engage in "looking ahead" and the subsequent "challenges" as these are similar to entry points and approaching the core respectively. Encouraging students to tell analogies during "generating ideas" may also be a way to apply his theory in this model.

A Visual Representation of the STAR Legacy Shell



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Theory/Perspective: Multiple Approaches to Understanding© **Key Proponent:** Howard Gardner, Harvard University

Major Contributions

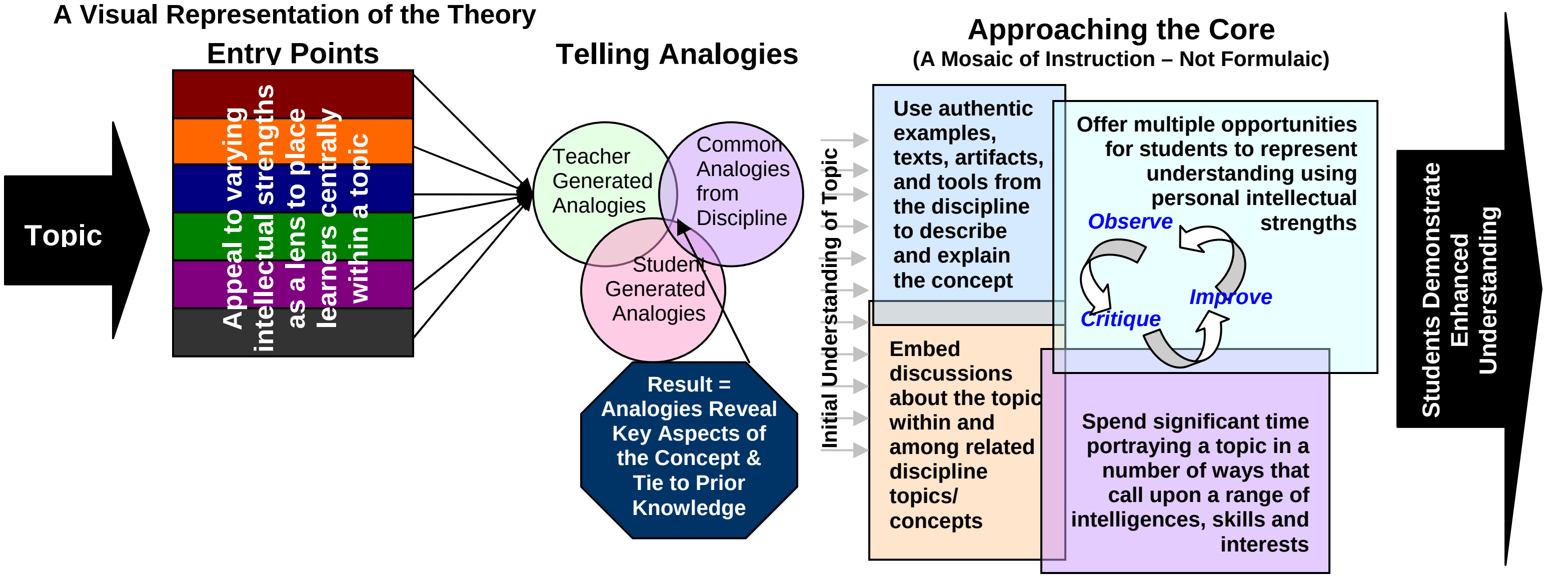
The following are the major contributions I believe Gardner's theory brings to the practice of instructional design:
Tangible View of Understanding: Gardner contributes a more tangible view of a "fuzzy" concept – understanding as an educational outcome. He does this by defining an approach where "frequent performances" along with observation, critique, and improvement promote enhanced understanding of the material to be learned.
Customization to Specific Intellectual Strengths: Gardner's viewpoint differs from other "generic" performance-based approaches to understanding (i.e. Perkins & Unger, 1999). Gardner proposes that we *customize* our instructional approach to enhancing understanding based upon students' varying intellectual strengths and interests (p. 73).
Encourages Cognitive Complexity Around a Few Core Topics: Gardner's approach moves us toward a type of learning that promotes understanding relationships between complex mental representations of core disciplinary topics. Additionally, this approach allows for the application of generic skills such as metacognitive strategies. This theory also challenges users to question "covering" a breadth of discipline topics in lieu of covering a few core topics in depth.
Connection with Achievement Motivation: This theory is closely aligned with mastery oriented environments (see Ames, 1992; Maehr & Midgley, 1991; and Maehr, 1994). This type of environment has demonstrated valued outcomes such as willingness to choose tasks that are challenging, help seeking, a focus on applying effort in order to achieve educational goals and development of intrinsic interest in learning (Pintrich & Schunk, 2002).

Applying the Theory

I believe instructional designers should account for the following when applying this theory:
Depth and Organization of Curricular Topics: To fully apply this theory it seems important for designers to consider how topics/ objectives of a curriculum may be (re)organized into a few rich and multi-faceted core topics with related sub-topics. Even if a complete reorganization of the curricular topics is not possible given the constraints of the project, the principles and model proposed can be applied when the topic(s) to be addressed have sufficient depth.
Design, Development, and Implementation Timeline: Allow sufficient time for the design, development and implementation of instructional materials that speak to learners' multiple and varied intellectual strengths. For example, this approach may require designing and developing more than one "Entry Point" related to the topic from which students may choose to begin their exploration. Additionally, during implementation, instructors must allow adequate time for students to demonstrate their understanding, receive feedback and attempt to demonstrate improvement.
Choosing a Platform: Though this theory can be applied in any platform (i.e. face-to-face, online, or a blended environment) the designer should consider the capacities and constraints each offers in light of the elements of this theory. For example, in the theory instructors are to offer a fair amount of feedback to students (i.e. as students engage in "Telling Analogies"). Thus, the designer should consider whether the platform can support delivery of useful feedback. Other issues related to the platform to consider include: the ability to support delivery of varied options for "entry" into a topic and the ability of the platform to host multiple and varied demonstrations of understanding from students.
Use of Authentic Tools and Artifacts in Approaching the Core: Though it isn't expressly written, the examples Gardner uses seem to call for use of *authentic* tools and artifacts used by experts in the field throughout instruction. For example, as designers consider approaching the core it seems prudent to consider using authentic tasks, texts, artifacts and tools from the discipline to describe and explain the concepts in varied ways.

Relevant Notes/Things/Pieces/Principles

A Visual Representation of the Theory



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EDCI 674, Fall 2007

Constructivist Learning Environments

David Jonassen – Pennsylvania State University

Major Contributions

A Model to Bring it All Together – The approach offered by Jonassen provides a theory that brings together the notions discussed in numerous other theories regarding cognitive learning designs (i.e. Schank, Bransford, Merrill, Perkins, etc). Snelbecker (1999) makes a call for the integration of design theories. This particular perspective makes a strong attempt at bringing together many constructivist notions about design, including individual and social constructivism.

Direct Recognition of Social/ Contextual Issues Associated with Design Implementation – Other theories discuss the notion that design theories must consider social and contextual features (i.e. Bransford and Perkins & Unger). Jonassen, however explicitly addresses the impact social and contextual issues have on design. The theory encourages *alignment* of the constructivist learning environment with local social and contextual constraints.

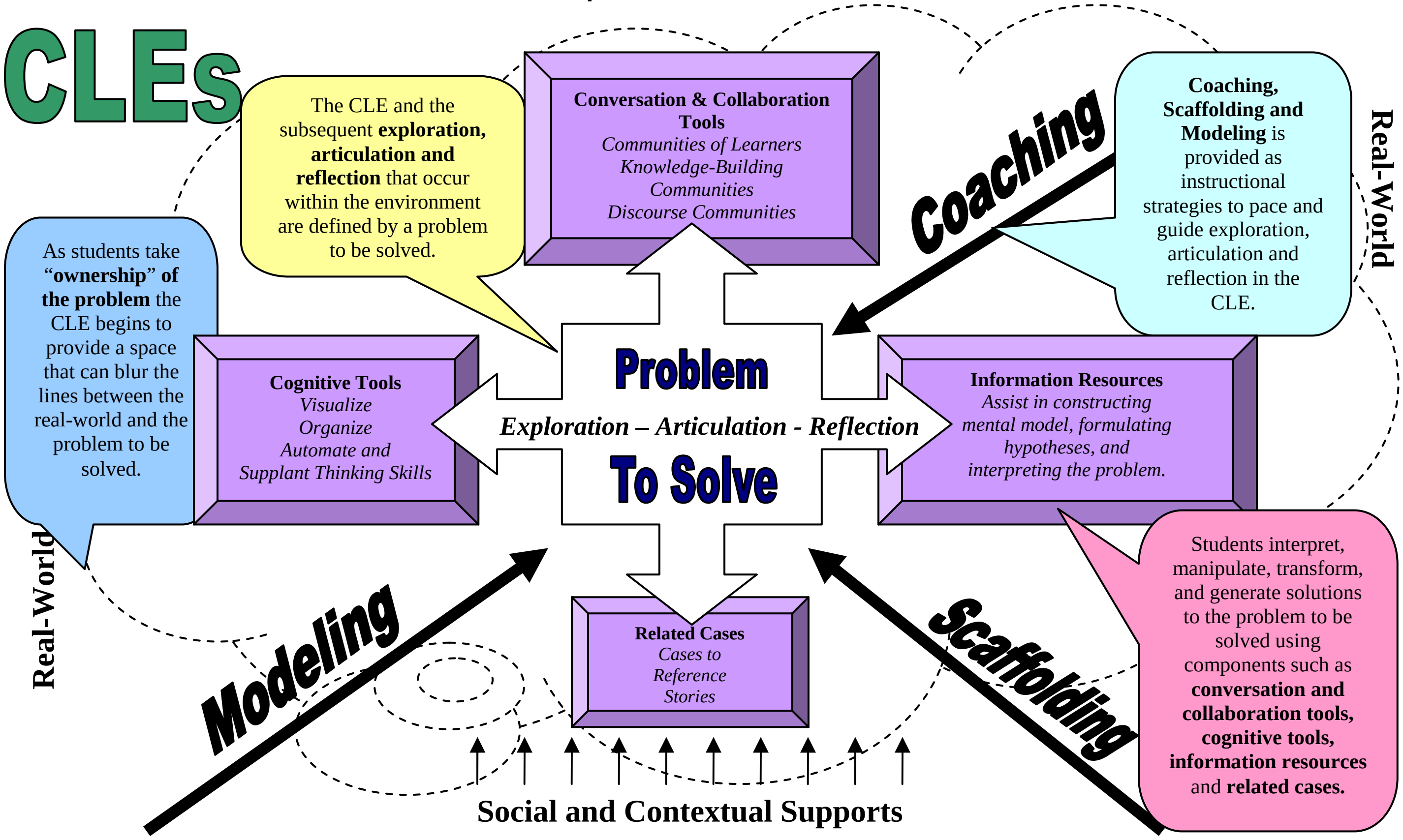
Applying the Theory

Thoughtfulness in Selecting the Type of Problem to Incorporate – At the heart of the Constructivist Learning Environment (CLE) is the problem selected. Jonassen (1999) discusses that CLEs can be constructed to support numerous forms of "problems." For example, CLEs can support question-based, issue-based, case-based, project-based, goal-based, and problem-based learning (p. 219). Jonassen's discussion of problems is relatively moot regarding how to select and develop a problem. It seems very important for the designer to give careful thought in selecting the type of problem upon which to base the CLE. While there doesn't appear to be an algorithmic approach to selecting the problem I would suggest that some problems may "fit" particular topics better than others. Some factors that seem important to consider include: authentic questions, issues and problems studied in the discipline or workplace, depth of the topic, issue and/or problem, whether the problem is well-defined or ill-defined, social and contextual supports available, and the general readiness of the learners.

Beware of Overwhelming the Learner – The elements of the CLE model do not inherently account for the pacing of the instruction. Simply designing from the model provided may produce an environment that has an overwhelming volume of information for learners as they try to solve the problem or produce a resolution to the issue posed. Coaching, modeling and scaffolding are offered as instructional strategies that a designer can use to temper and pace the learners' interaction with the information in the environment.

Construct A Visual Anchor to Mark Movement and Progress in the CLE – Bransford et al (1999) discusses the usefulness of a visual anchor in an environment that supports constructivist learning (e.g. the "cycle" used in the STAR Legacy shell). It seems that a visual anchor could be an additional element the designer adds to the CLE to assist in keeping the learner focused on the goal and the various elements that may be manipulated in an effort to reach that goal.

A Visual Representation of Jonassen's CLE



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SOI Model for Learning: Designing Instruction for Constructivist Learning

Richard Mayer, University of California, Santa Barbara

Major Contributions

Everyday Application for Designers: The theory proposed by Mayer has practical implications for everyday instructional design work. It seems that this particular approach may be implemented in concert with many other theories to enhance the probability that students will retain and transfer the instructional messages in the environment.

Contrast to Popular Views of Constructivist Learning: This particular theory serves as an important reminder that constructivism is not a unified view of learning. In light of popular (and useful) social constructivist views we often forget that "individual mental processes" also provides a useful view of constructivism.

No Behavioral Manipulation Required – This particular theory provides an approach that supports designing for situations where behavioral manipulation may or may not be feasible, or when manipulation cannot be monitored directly. For instance, in designing an "online" course one cannot always track or verify the completion of some learning activities (i.e. offline labs students must complete, etc). This particular approach, while it doesn't replace the need for those kinds of hands-on learning tasks, does provide an approach that increases the probability of retention and transfer.

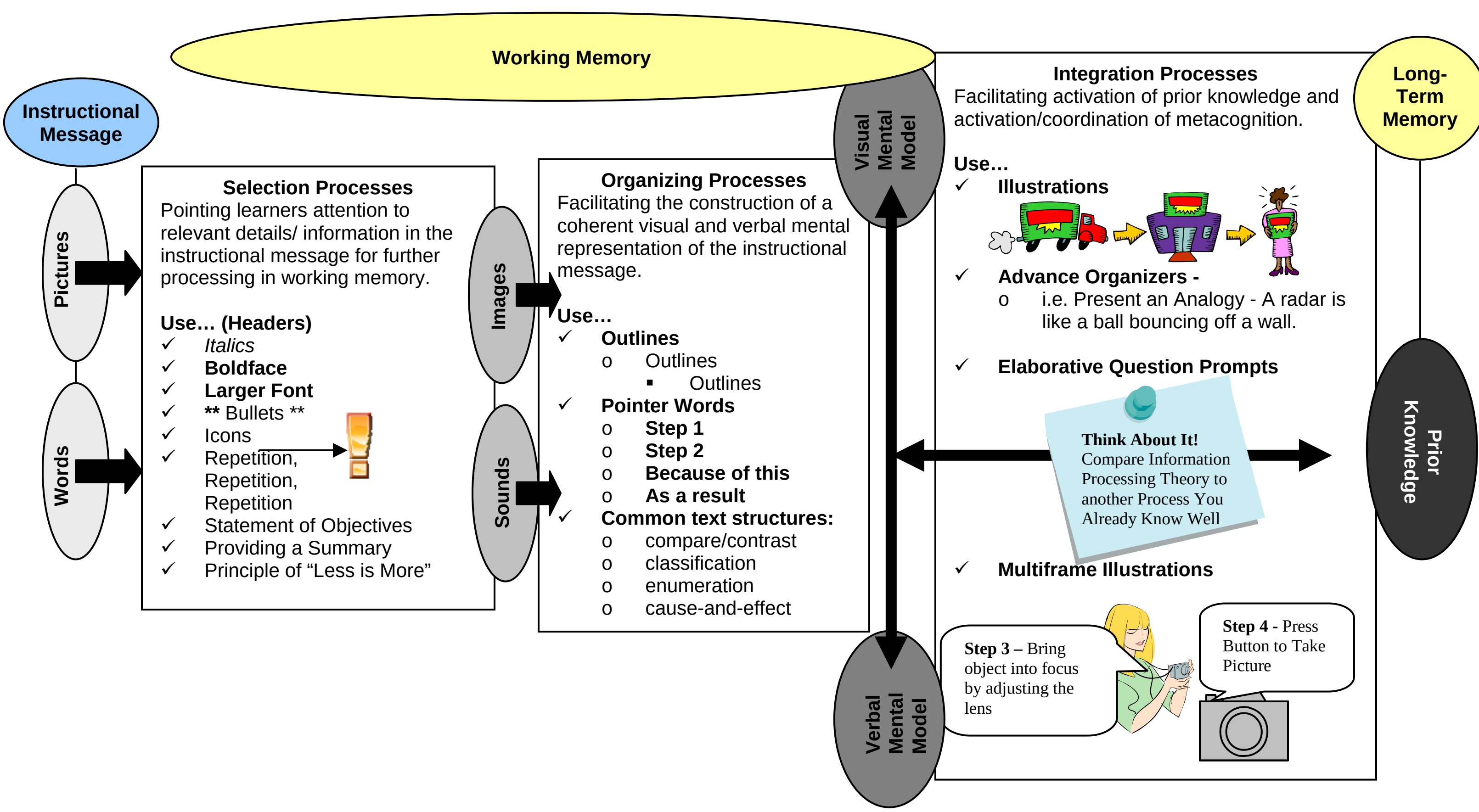
Applying the Theory

Applies to Both Text-Based (Static) and Multi-Media (Dynamic) Environments – IDers trying to apply this theory may find it's core elements of Select, Organize and Integrate apply to auditory and visual representations that make up instructional messages in both static and dynamic environments.

Mix and Match – IDers will likely find that this approach may be most effective when used with other theories to create an effective, and eclectic, model for an instructional design project. However, depending upon the nature of the project it may be the most appropriate theory to support the overall design.

Create a Style Guide of Consistent SOI Elements for Each Project – It seems important to be very purposeful and consistent (within each project) in the methods a designer selects and uses to facilitate learner's selection, organization and integration of concepts. For example, if "margin notes" are chosen as a method to facilitate students "selecting" the appropriate concepts then the margin notes need to be somewhat consistent in both use and formatting throughout the entire instructional sequence (or text). To facilitate this level of purposefulness and consistency within a project a designer could create a checklist or "style guide" to guide the use of various methods.

A Visual Representation of the Theory



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EDCI 674, Fall 2007

Instructional Transaction Theory

M. David Merrill – Utah State University

Major Contributions

A Focus on Automation in ID – Merrill's theory grew, in part, from a desire to address the inadequacies of a frame by frame approach to computer based training (i.e. the lack of instructional effectiveness and issues with development efficiency such as reducing the intense amount of labor involved in frame-by-frame construction). A key feature the theory of instructional transactions affords IDers is the luxury of programming transaction shells only once. From there various interfaces allow for both the IDer and the SMEs involved to input, and/or change values, in the system to produce the desired learning outcomes using the various transaction shells available.

A Focus on Holistic Tasks – A hallmark of the industrial paradigm in ID theory was breaking larger tasks down into singular behaviors and then teaching each of those component behaviors in an effort to build toward the larger task (i.e. listing the enabling objectives for a terminal learning objectives and then teaching to the enabling objectives). Instructional Transaction Theory focuses on instruction for holistic tasks through the use of instructional transactions. An instructional transaction is all of the learning interactions necessary for a student to experience to be able to do the targeted task. While it still bears some reflection to the previous models the instruction produced is re-focused on the overall task/ problem to be solved rather than the component parts.

Serves as a Boundary Object Between Multiple Related Communities of Practice – Wenger (1998) describes that boundary objects serve to "link" participants in multiple communities of practice together. In this case, Merrill is describing a theory that draws from discourse in learning theory, instructional design theory, instructional systems development, programming, etc. In doing so, he enriches the quality of the theory he provides. As we work within the information age paradigm it will likely be more common to see theories that are derived from discourse in multiple related practices.

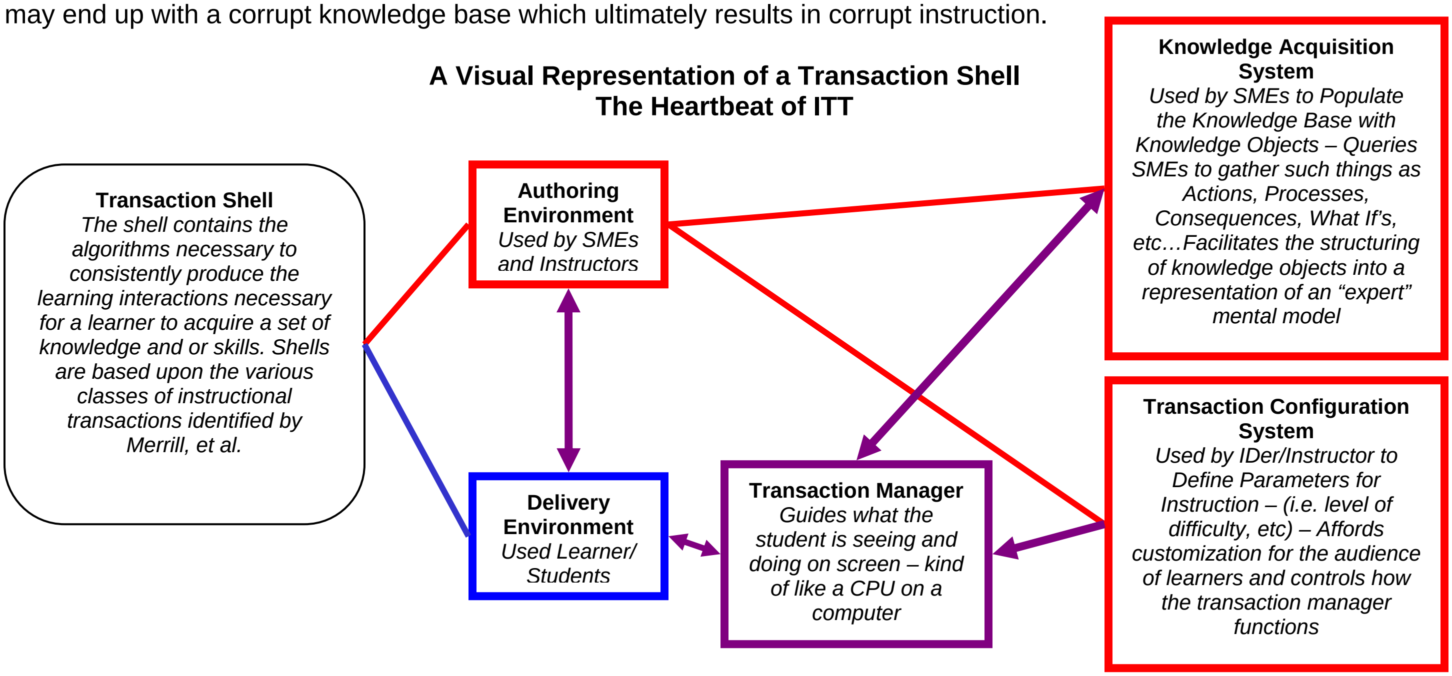
Applying the Theory

A Change in the Upfront Analysis - Rather than the usual task analysis (focused on decomposition of tasks), it seems that the type of analysis required by this theory may be different. For example, when designing within this theory the IDer might first seek to identify the targeted holistic tasks/problems to be solved and then subsequently identify more challenging versions of that task/ problem to be solved. (A slight variation on what Reigeluth seems to outline in his Simplifying Conditions Method - as he suggests beginning with the simplest version of the task and then move toward more complex until you've achieved the desired level of expertise.)

Careful Consideration of the Instructional Transaction – Merrill's 13 classes of instructional transactions should be considered once the IDer knows more about the actual nature of the target problem to be solved or holistic task to be completed. The various instructional transactions described provide the basis for the various algorithms programmed within each "transaction shell." Thus, it seems prudent for the nature of the task/problem to be carefully matched with the type of instructional transaction(s) that will best facilitate the learning goal (i.e. acquiring expertise in a particular area).

A Need for Well-Trained SMEs – Even though the computer system Merrill has created utilizes an interface specifically designed to facilitate the collection of knowledge objects from SMEs; it still seems very prudent for there to be some training with the group of SMEs prior to just "turning them loose" with the program to gather their input. Otherwise you may end up with a corrupt knowledge base which ultimately results in corrupt instruction.

A Visual Representation of a Transaction Shell
The Heartbeat of ITT



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EDCI 674, Fall 2007

Elaboration Theory

Charles M. Reigeluth, Indiana University

Major Contributions

SCM Focuses on Complex, Real-World Tasks – Many of the new approaches to instruction (i.e. Merrill, Schank, Bransford) take a holistic approach to instruction. Thus sequencing in the new paradigm needs to address sequencing issues to help individuals learn to complete complex real-world tasks. SCM offers a way to do just that. This is in stark contrast to previous approaches that focus on breaking content into pieces and then sequencing that content.

Theoretical and Conceptual Elaboration Promotes Accurate Schema – Humans have a natural tendency to categorize new phenomena (both conceptual and causal) into hierarchies. Due to great diversity in our experiences we often don't end up with schema (either conceptual or causal) that often reflects accurate organizations of a particular domain. Theoretical and conceptual elaboration sequences address this and provide a way to promote the development of accurate and useful schema within particular domain areas.

Provides Newcomers with Access to Legitimate Forms of Participation - From a socio-cultural perspective, when a "new-comer" is introduced to tasks within a practice they often don't gain "access" to the implicit knowledge shared among the group of experts. This can result in barriers that impede the acquisition of expertise. Reigeluth's theory and the Simplifying Conditions Method (SCM) interlocks the heuristic (tacit) knowledge in with the procedural knowledge making it possible to provide "access" to newcomers and may speed up the development of expertise.

Applying the Theory

Sequencing/Kind of Expertise Relationship – Reigeluth bases elaboration theory upon the assumption that certain sequencing strategies that better "fit" the kinds of relationships represented in different forms of expertise. The kind of sequencing chosen by the IDer (theoretical, conceptual, or SCM) should be based upon the kind of expertise desired (task or domain).

Allowance for Direct and Constructivist Instruction – Reigeluth's theory isn't bound to either purely direct or purely constructivist learning programs. In fact, he makes it clear that his approach may be used in both directed and constructivist learning environments.

Rapid Prototyping – The SCM makes it possible to do rapid prototyping so that the first learning episode can be designed and delivered before any task or content analysis is done for the remaining versions of the task to appear in the course. Additionally the traditional task/content analysis and sequence design may be done simultaneously.

Applies Most Clearly to Complex Tasks – The theory was created with complex tasks and domain knowledge structures in mind. This theory and the approaches discussed will likely not fit in situations where the task or problem-to-be-solved is rather rote/narrow in nature.

Multi-Strand Sequencing – Many subject-domains may promote understanding of both conceptual and theoretical knowledge structures. Bessiner & Reigeluth (1994) offer multi-strand sequencing as a method to address this situation.

A Visual Representation of the Theory

Domain Expertise

Conceptual Elaboration Sequence

Applies to…
- ✓ Understanding "what"
- ✓ Concept maps
- ✓ Conceptual knowledge structures

Based upon…
- ✓ Concepts are groupings of objects, events or ideas
- ✓ Concepts can be decomposed into less inclusive concepts that are "parts" or "kinds" of the larger concept
- ✓ People tend to store a new concept under a broader grouping (accurately or inaccurately)

Sequencing Tips
- ✓ Start with the broadest, most inclusive, general concept (not yet learned)
- ✓ Proceed to more narrow parts and kinds of the broader concept
- ✓ May use topical or spiral structure for delivery
- ✓ More narrow, concrete concepts are usually easier to learn – but to ensure accurate schema it is helpful to start with the broadest concept
- ✓ Uses Conceptual Analysis

Theoretical Elaboration Sequence

Applies to…
- ✓ Understanding "why"
- ✓ Causal models
- ✓ Theoretical knowledge structures
- ✓ Ideal for problem-based learning and other discovery approaches

Based upon…
- ✓ Principles are either causal relationships or natural-process relationships among changes in concepts (i.e. law of supply and demand)
- ✓ Principles exist on a continuum from broad to narrow and specific
- ✓ People tend to store more narrow principles underneath more inclusive principles

Sequencing Tips
- ✓ Start with the broadest, most inclusive principle (not yet learned) and proceed to more narrow/specific principles
- ✓ Utilize theoretical analysis to identify the architecture
- ✓ Broader principles are usually easier to learn than more narrow principles (this is opposite of concepts)
- ✓ May use either topical or spiral sequencing to deliver

Task Expertise

Simplifying Conditions Method Sequence

Applies to…
- ✓ Understanding "how" and "when"
- ✓ Complex tasks (involving procedural, heuristic or combinations of both knowledge structures)

Based upon…
- ✓ Situated views of expertise development
- ✓ Socio-cultural views regarding participation in communities of practice

Sequencing Tips…
- ✓ Begin with the simplest version of the task (still representative of the task as a whole)
- ✓ Teach progressively more complex versions of the task until you reach the desired level of expertise
- ✓ May complete task analysis and sequencing at the same time
- ✓ May apply to both procedural tasks and heuristic tasks – although most complex tasks involve both heuristic and procedural knowledge
- ✓ Epitomizing and elaborating are the two analysis processes involved in using the method
  - o Epitomizing = identifying simplest version of the task
  - o Elaborating = identifying progressively more complex versions of the task

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Goal Based Scenarios as an Approach to Fostering Case Based Reasoning

Roger C. Schank, Institute for the Learning Sciences at Northwestern University

Major Contributions

Humanizes Learning Theory – Schank's CBR theory brings a view of learning from a more holistic vantage point. CBR deals with how people acting in various contexts construct, store, and retrieve experiences and information (procedural or content knowledge). This viewpoint contrasts with other descriptive theories (i.e. information processing theory) which focus on the dissection of the various component parts of learning processes. Schank's theory seems to value the fact that humans learn and engage in complex environments. This viewpoint humanizes the "learning" process by offering a pragmatic heuristic to explain how we come to know and act on a daily basis.

"Knowing in Doing" Enacted - This particular theory enacts the notion of knowing in doing as posited by several authors from the situated learning perspective (i.e. Lave & Wenger, 1992 and Brown, Collins & Duguid, 1989). Notions from the situated learning perspective, while powerful to consider, are often difficult for an IDer (at least for me) to wrestle into a design that can feasibly be enacted in most learning environments without having to change the supersystem in which the learning environment operates. This particular approach makes such efforts to enact "knowing in doing" concepts feasible without making immediate changes to the supersystem in which the learning will take place.

Applying the Theory

Deliver In Person, Online or Blended – Depending upon the constraints of the project, the IDer may choose to design the GBS for either live or online delivery. There could also be a blend between live and online delivery.

Storytelling Prep – When using stories as a resource or part of offering feedback it is imperative that sufficient time is allocated to story construction. Thoughtfulness in this area can ensure the message truly embeds the target knowledge and skills to ensure maximum transfer and accurate indexing.

Grounded But Novel Mission, Cover Story and Role – Schank highlights that the goal and mission delivered to the learner should neither be completely fantasy nor does it have to be completely rooted in the student's everyday reality. The "set-up" should be somewhere in between these two extremes. The elements included in the set-up should allow for the student to relate to the mission and goal and it should involve some level of novelty as to maintain learner interest.

Consider Integrating GBS with Hannafin's OLE – Beyond offering taxonomy for the types of "contexts" that enable the learner to discover a "problem to solve" Hannafin's OLE model was relatively moot regarding the construction of the problems to solve. Schank's theory fills in this particular gap with explicit instructions for creating an externally imposed or externally induced enabling context through the use elements prescribe for creating a GBS. However, Schank's theory is less explicit about the various types of resources, scaffolds, and tools to make available to learners as they approach the GBS. The two models seem to act as complementary models for an IDer to utilize when working on a project that calls for the use of problem-based learning (i.e. Hannafin's provides the "shell" and Schank's supplies the "content" to fill the shell).

A Visual Representation of the Theory and Approach