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A Task-Centered Instructional Strategy

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Abstract

Based on a review of instructional design models, previous papers identified first principles of instruction. These principles prescribe a cycle of instruction consisting of activation, demonstration, application, and integration. These instructional phases are best implemented in the context of real-world tasks. A Pebble-in-the-Pond approach to instructional development prescribes a task-centered, content-first instructional design procedure, which implements these first principles in the resulting instructional products. This conceptual paper elaborates the component analysis and instructional strategy phases of this instructional design model. This paper also integrates previous instructional strategy prescriptions from Component Display Theory with the content components of knowledge objects. The strategy for teaching within the context of a whole task consists of applying strategy components to these various knowledge components in a way that enables learners to see their interrelationships and their relationship to the whole. The resulting instructional strategy is a guided task-centered approach as contrasted with more learner-centered problem-based approaches to instructional design. The application of this component analysis and task-centered instructional strategy is illustrated. (Keywords: Pebble-in-the-Pond instructional design, first principles of instruction, Component Display Theory, knowledge objects, task-centered instruction, whole-task instruction, task progression, knowledge and skill components, component analysis, instructional strategies.)

INTRODUCTION

During the past few years there has been a flurry of activity exploring problem-based instruction (Jonassen, 2000; Spector, 2004). There are many names and variations of these approaches including guided discovery learning, model-centered instruction, problem-based learning, situated learning, case-based learning, and exploratory learning. Each of these approaches has in common getting learners involved with whole tasks or problems as contrasted with the topic-by-topic approach that typifies more traditional curriculum approaches. The belief is that getting students involved with realistic whole situations will help them form appropriate schema and mental models. These more complete internal representations are believed to facilitate their later application of their newly acquired knowledge and skill.

Problem-based approaches vary widely in the amount of learner support that is provided. Learner support can take the form of scaffolding, learner guidance, or coaching. At one extreme are minimal guidance strategies that select students for a cohort, give the group a complex ill-structured task to complete, and provide resources of various kinds from which the learners are expected to find and apply the information they need to complete the task. Students collaborate with one another, sharing information, seeking solutions, and exploring alternatives until they are able to complete the assignment. Some reviewers have cited data that indicates that approaches that provide minimum guidance are often ineffective and inefficient (Kirschner, Sweller, & Clark, 2006; Mayer, 2004). At the other end of the continuum the strategies are more structured and provide the student with considerable learner guidance (van Merriënboer, 1997; van Merriënboer & Kirschner, 2007). For learners already familiar with a given content area unstructured exploratory learning approaches may be appropriate, however for learners who are novice in a content area, learner guidance is essential.

The task-centered instructional strategy presented in this paper is a structured approach and represents a form of direct instruction in the context of real world problems. The emphasis is on demonstration (worked examples) rather than on discovery or exploration. While collaboration can certainly be employed, it is not a central or required part of this approach. Students can undertake a task-centered approach as an individual learner as well as in a group. This task-centered approach integrates component knowledge and skill acquisition with the doing of complex tasks. Topic-centered approaches, typical of much current instruction, may be sufficient for acquiring foundational skills or to enhance the skills of advanced technical learners. However, for learners new to a content area, integrating component knowledge and skills into whole tasks results in higher motivation and a better ability to apply the newly acquired skill in new situations.

Much of our earlier work was on strategies for teaching individual skills and acquiring different kinds of learning outcomes (Merrill, 1983, 1987, 1988, 1994, 1997; Merrill, Tennyson, & Posey, 1992). In collaboration with Robert Gagné, we began to think about a more integrated approach (Gagné & Merrill, 1990). While attempting to identify first principles of instruction we found that instruction in the context of complex, authentic, real-world tasks was a critical part of an engaging instructional strategy (Merrill, 2002a). While attempting to find ways to automate some of the instructional design process, we developed ways to specify the content to be learned in terms of knowledge objects (Merrill, 1998, 2001c). In this paper all of these separate strategies are brought together in an integrated, multi-strand strategy for teaching how to solve real-world problems or for how to complete complex real-world tasks.

FIRST PRINCIPLES OF INSTRUCTION

We have previously identified first principles of instruction (Merrill, 2002c, 2002a, 2006, 2007, press-a). These principles describe a cycle of instructional phases consisting of activation, demonstration, application, and integration all in the context of real world problems or tasks. We have previously described knowledge objects consisting of an entity, its parts, properties, associated activities and processes (Merrill, 1998, 1999, 2001a, 2001b, 2002b). This paper brings these two ideas together to describe the knowledge components of a whole task and how these knowledge components can be sequenced for efficient, effective, and engaging instruction.

Figure 1 states these first principles of instruction. This paper will bring these principles together into a systematic task-centered instructional strategy.

PEBBLE-IN-THE-POND APPROACH TO INSTRUCTIONAL DESIGN

Figure 2 (page 8) illustrates a Pebble-in-the-Pond approach to instructional design. Compared to other instructional development approaches this model

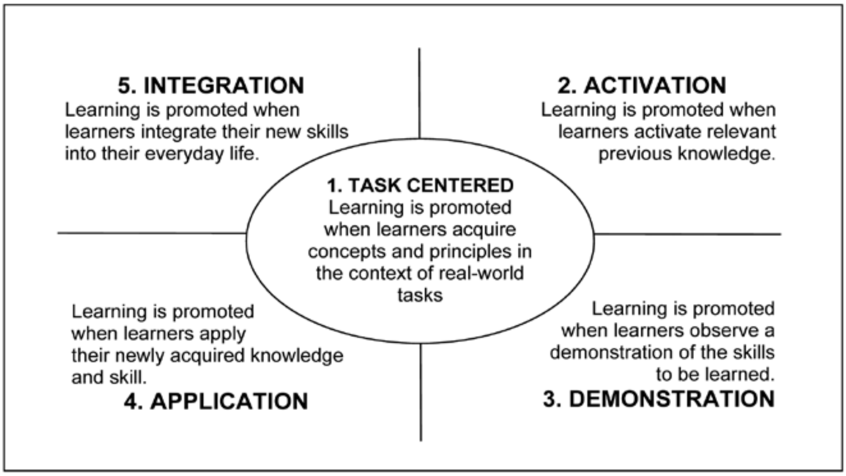

Figure 1: First principles of instruction.

more effectively designs products that incorporate first principles of instruction. The Pebble model offers a different approach to content analysis as compared with more traditional instructional systems development (ISD). Traditional ISD specifies objectives in the analysis phase early in the design process but doesn't specify the actual content to be taught until later during the development phase. Objectives are abstractions that represent the content rather than being the actual content itself. The Pebble model is a content-first approach. The first steps in this approach identify a collection of real-world tasks that will later form the actual content of the instruction. The first step identifies a typical whole task and produces a fully worked out example of that task. The second step identifies a series of similar tasks of increasing complexity. The third step identifies component skills common to these tasks. In this Pebble model designers specify the content to be taught up front and only later combine this content with an instructional strategy to provide the complete instructional design.

This paper elaborates the first four ripples in this design model: (1) specify a real-world task, (2) identify a progression of tasks, (3) specify component knowledge and skill for each task, and (4) specify an instructional strategy for task-centered instruction. It should be noted that the first three phases in the Pebble model are concerned with the task-centered, first principle and specify the subject matter content to be taught before there is consideration for how this material will be taught. Starting with whole tasks assures that the component knowledge and skill to be taught are relevant and integrated.

Only in the fourth phase, after the content has been identified and specified, does the Pebble model specify the instructional strategy to teach this content. Effective instructional strategies for whole tasks and for the component knowledge and skill that comprise these tasks require consistent *demonstration* and *application* at both the individual component level and at the whole task level. The instructional strategy described in this paper emphasizes *demonstration* and *application*.

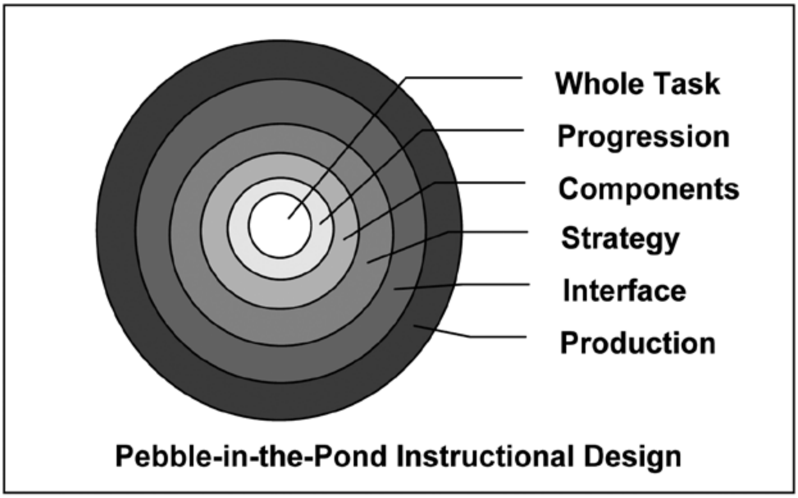

Figure 2: A Pebble-in-the-Pond approach to instructional design.

SPECIFY A REAL-WORLD TASK

The central first-principle of instruction is *task-centered*. The first ripple in the pebble model identifies a specific complete real-world task and a worked example of this task. A real-world task is one that learners can expect to encounter in their life following instruction. It can stand alone but it may also be a component of an even larger task. A real-world task is one specific instance of a class of tasks for which there are multiple specific instances. It is a complete task that includes at least three components: (a) inputs—the givens of the task; (b) a goal—the identification of the product or activity that results from performing the task; and (c) a solution—a set of activities that transforms the givens into the goal. It also includes an illustration of the problem-solving process—a representation of someone actually performing the task.

Real-world tasks are not contrived. They often do not have a single correct answer. They can often be solved in several ways and the resulting artifact or activity can take several forms. The best representation of the task allows learners to do the task in its natural setting. Figure 3 shows a design approach for a task-centered course.

The specification of a real-world task should also include the criterion for acceptable performance. How do you know when the learner has completed the task or solved the problem in a satisfactory or a superior way? What are the properties to be used for rating learner performance?

IDENTIFY A PROGRESSION OF TASKS

The second ripple in the pebble model is to specify a progression of tasks. Each task in the progression should be complete, not merely a step in a larger task. Each task should be a worked example from the set of similar tasks. Each task in the progression, while varying from preceding tasks, requires the same or similar knowledge and skill components. Each task in the progression is a por-

A Task-Centered Course in Entrepreneurship

The Center for Instructional Technology and Outreach at Brigham Young University developed a task-centered course in Entrepreneurship (Mendenhall et al., 2006a, 2006b). The primary goal of the course is to teach the fundamental steps for starting a business to non-business majors in developing countries. The whole task involves six steps: (1) Identify a business opportunity, (2) Define the idea, (3) Identify resources, (4) Acquire resources, (5) Start your business, and (6) Manage your business. The course is organized around scenarios for five real-world businesses in developing countries. The first whole task for this course is Veanesa's Pig Farm, a small product business in Cambodia. Space limitations in a short article preclude a complete description of this task here. Please refer to the on-line course referenced above to study this example of a whole task.

Figure 3: Elaboration example of a task-centered course design.

trayal (worked example) of the task, not merely a description. Since the task in the progression are the actual content to be taught it is important to make sure that the task examples are complete.

In a good progression each succeeding task is more complex than the preceding task. A more complex task involves more detail for some component skill or more component skills than the preceding task. In Elaboration Theory this is the *simplifying condition* (Reigeluth, 1983, 1999; Reigeluth & Rogers, 1980). To manage cognitive load it is advisable to introduce only a limited number of new components or revised components for each succeeding task. The first task is the easiest version of the whole task. The last tasks are representative of the more complex tasks to be performed in the real-world. While each succeeding task is of the same type they should be as divergent as possible from the preceding task. It should vary in those ways that tasks in the same class differ in the real world. It is by learning to do a variety of different tasks of the same type that learners acquire the ability to transfer their knowledge and skill to yet unencountered tasks of this type.

Each task may not include all of the component skill that is the goal of the instruction and that is required to complete all of the tasks in the progression. However, all of the component skills required by the final tasks should be included in the total set of tasks in the progression.

For very complex tasks it may be necessary early in the instruction to progressively increase the complexity of a single whole task. In this approach the progression has two phases. In the first phase a portion of the whole task is presented at the beginning of the progression and each subsequent task increases the complexity of this single task. In the second phase, after the first whole task has been learned, then learners should be given the opportunity to interact with additional whole examples of this more complex task.

The following steps have been found useful in specifying a progression of whole tasks (see Figure 4 on page 10 for an elaboration).

Entrepreneur Course Task Progression

In the Entrepreneur course there are five whole tasks, each a scenario describing a small business in a developing country: (1) Veasna's Pig Farm, a product business in Cambodia, (2) Instant Service Carpet Cleaning, a service business in Mongolia; (3) Da Kine Wireless, a retail cell phone business in Laie Hawaii; (4) Fiesta Mexican Café, a restaurant business in Russia; (5) Kahn Sub, a fast food business in Mongolia. Each successive business in this progression is more complex that the preceding business. Each of the businesses involves all six of the fundamental steps for starting a business but the details of each step get more complex for each business in the progression. See the on-line course for more details about this progression of tasks.

Figure 4: Task progression in the exemplar task-centered course.

1. Gather a set of specific whole tasks. Often it is possible to gather artifacts in the workplace. For processes it is often possible to video samples of the process in the workplace.
2. Identify the components required for each task (see component analysis).
3. Sequence the tasks by putting the least complex tasks early in the progression with succeeding tasks those that have more elaborated knowledge and skill components or more component skills than preceding tasks.
4. Adapt the tasks or select alternate tasks as necessary to facilitate a smooth progression and to best enable demonstration and application of each component skill.

SPECIFY COMPONENT KNOWLEDGE AND SKILL

Information versus Portrayals

Subject matter content can be represented in two ways: as *information* or as *portrayals.* Information is general, inclusive, and refers to many cases or situations. A portrayal (real-world example) represents a specific instance of the information. Portrayals are limited and refer to one case or a single, specific situation. Learners can remember information but to use this information learners need to see this information applied to real-world examples (demonstration) and they need the opportunity to try to use this information with additional real-world examples (application). To be useful in instruction, content analysis requires the specification of both information and portrayals.

Knowledge Objects

Subject matter content can be represented by a collection of content components, which is called a *knowledge object.* A knowledge object is a framework consisting of containers for different kinds of general information and specific portrayals (the knowledge components) that are required for instruction. This knowledge framework is the same for wide variety of different topics within a subject matter or for knowledge in different subject matter domains (Merrill, 1998, 2001c). Specifying knowledge and skill consists of specifying information

Table 1: Knowledge and Skill Components for Different Learning Outcomes

Learning Outcome	Remember Information (knowledge)	Apply Information to Portrayal (skill)
Information about	Remember the description of an entity.	Given a description recognize a given instance of an entity.
Parts-of	Remember the names and description of the parts of an entity.	For a given entity, locate the parts in the context of the whole.
Kinds-of	Remember the definition—the property values that define a class of entity.	Classify examples—identity entity portrayals that belong to a specific class of entity.
How-to	Remember the steps—a sequence of action names or descriptions.	Do the task—execute the actions in the sequence.
What-happens	Remember the name, description, conditions and consequence for the process.	Given the conditions predict a consequence or given a consequence find missing or faulted conditions.

or portrayals for each of the slots in this knowledge object. This paper describes a knowledge object for a whole real-world task.

Kinds of Instructional Knowledge and Skill

We previously identified five kinds of knowledge or skill that can be acquired as a result of instruction: *information-about, parts-of, kinds-of, how-to, and what-happens* (Merrill, 1997). Table 1 describes each of these instructional outcomes in terms of components of a knowledge object. The knowledge object for a whole-task described in this paper is comprised primarily of *kinds-of* and *how-to* knowledge and skill.

A Knowledge Object for a Whole Task

Figure 5 illustrates the knowledge and skill components and the knowledge analysis procedure for a whole task. The first step in this analysis is to select a specific whole task that represents the kind of task that a student should be able to complete as a result of the instruction. A knowledge object for this specific whole task consists of a combination of information and portrayal for various *kinds-of* and *how-to* knowledge components. A whole task consists of a series of sub-tasks leading to a desired consequence or outcome. Each of these subtasks in the whole task is comprised of a series of *how-to* information components illustrated by the shaded arrows.

Completing a given subtask produces a portrayal of a specific object or event (artifact). These portrayals are represented by the white documents in the figure. Each of these artifacts is an instance or *kind-of* some class. As such each artifact has associated with it a list of defining properties (a definition) that determine

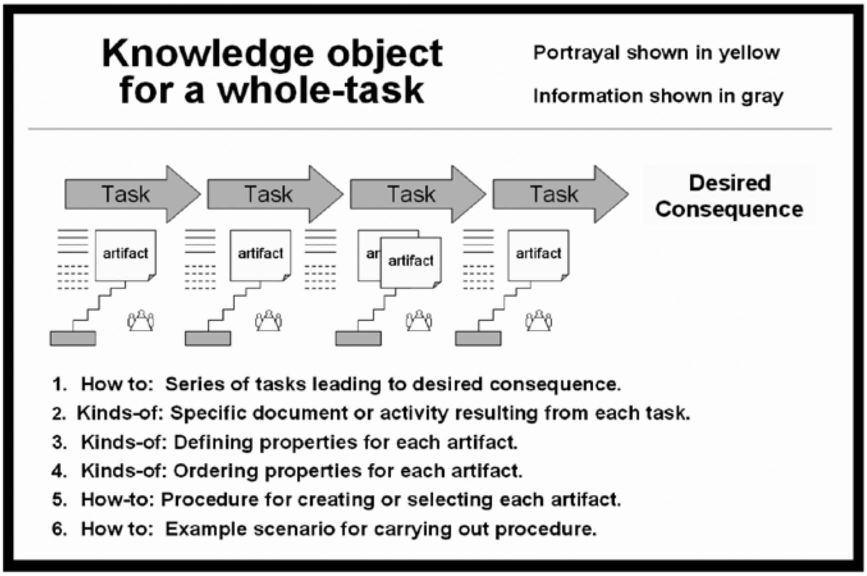

Figure 5: A Knowledge Object for a whole task.

its class membership. The solid lines to the left of each artifact in the figure represent this list of defining properties. These defining properties comprise a check-list that can be used to determine if a given artifact is really a member of the category under consideration. However, since a given artifact is only a single instance of a larger class of artifacts then it is also important to identify a set of ordering properties by which several artifacts from the same class can be ranked. The dashed lines to the left of each artifact represent these ordering properties. In other words these ordering properties comprise a check-list for determining the adequacy of a given artifact. Is it a good example of the class under consideration? The defining properties and ordering properties of a given artifact determine if the artifact is indeed an example of the kind-of object or event that results from the sub-task and if it is a good example.

However, merely recognizing that a given artifact is a member of a class and that it is a good example is insufficient to complete the task. The stairway under each artifact in Figure 5 represents a series of steps (*how-to* information) for *how-to* find or *how-to* create the artifact. The icon to the right of each stairway represents a portrayal showing someone actually carrying out the steps or doing the procedure (*how-to portrayal*).

Figure 6 illustrates a component analysis that brings these elements together. A complete knowledge object for a complex task consists of: (1) a desired consequence, a specific artifact for the completed task (a *kind-of* portrayal); (2) a series of subtasks required to find or create this consequence (*how-to* information); (3) associated with each subtask is one or more artifacts (*kind-of* portrayals) that result from the execution of the sub-task; (4) associated with each artifact or set of artifacts is a list of defining properties (*kind-of* information) and (5) a list of ordering properties (*kind-of* information); (6) also associated with

Sample Component Analysis for Entrepreneur Course

Consequence for the whole task—a complete business plan including a Performa, resource allocation, and accounting required to manage the business.
Steps: *(1) Identify Opportunity, (2) Define the idea, (3) Identify resources, (4) Acquire resources, (5) Start the business , (6) Manage the business.*
Artifact for Step 1: Statement of business opportunity

> *My brother told me that one of the two most needed things in Cambodia is pigs. More than 50% of the domestic meat consumption has been imported from the neighboring countries, mostly Thailand and Viet Nam. The cost of importing is high and the delivery time is long, and the pork quality is not consistent. Following recent outbreaks of the bird flu (which affects chickens and ducks) in South East Asia, many people have turned to eating other kinds of meat. There are also a lot of Chinese people in Cambodia, and Chinese people eat a lot of pork.*

Defining properties for Step 1: *Is there an unsatisfied need or want? Are there enough people? Are they willing to pay? Are they able to pay?*
Ordering properties for Step 1: *What is the evidence for an unsatisfied need or want? What is the evidence that there are enough people? What is the evidence that they are willing to pay? What is the evidence that they are able to pay?*
Procedure for Step 1: *the Entrepreneur Course did not list a procedure for developing or finding a business opportunity. A more detailed procedure would improve the course and give the student more guidance for completing this step.*
Scenario for Step 1: *Veasna went to the marketplace to see if people were purchasing pigs. He observed lots of people purchasing pigs daily. He asked an employee how many pigs they sell everyday. The employee said they usually sell most all of the pigs they bring to the market. A local butcher told me that if I could provide grown pigs every month, at a cheaper price than imported meat, he would buy from me.*
See the on-line course for a more complete illustration of the knowledge and skill components of this course.

Figure 6: Component analysis example for the task-centered exemplar.

each artifact, or set of artifacts, is a series of steps (*how-to* information) for finding or creating the artifact(s); and (7) an illustration of someone actually doing these steps to produce a given artifact (*how-to* portrayal). These are the knowledge components necessary to develop a task-centered instructional strategy, which this paper describes in the next section.

SPECIFY AN INSTRUCTIONAL STRATEGY

Components of an Instructional Strategy

Component Display Theory (Merrill, 1983, 1994) identified four primary instructional strategy forms: presentation (tell), demonstration (show), recall

Table 2: Instructional Strategies for Each Kind of Instructional Outcome

	Tell Information **Presentation**	Show Portrayal **Demonstration**	Remember (ask) Information **Recall**	Apply (do) info to portrayal **Application**
Info about	name–information	------------------	name–information	-------------------
Parts of	name–location	------------------	name–location	-------------------
Kinds of	definition	examples non-examples	definition	classify examples
How to	steps–sequence	demonstrate task	steps and sequence	perform task
What happens	statement of conditions–consequence if… then	demonstrate process	statement of conditions–consequence If … then	predict consequences or find conditions

(ask), and apply (do) [1]. Table 2 summarizes each of these four instructional strategy components for each of the five types of instructional outcomes (Merrill, 1997). This table is read as follows (refer to the third row of the table): For kinds-of content the presentation is *tell a definition* (information); the demonstration is *show an example* (portrayal); the recall is *remember the definition* (information); and the application is *classify a new example* (portrayal). The other rows can be read in a similar manner. In this paper we will present an integrated task-centered instructional strategy that incorporates strategies for teaching primarily the kinds-of and how-to knowledge components.

A Task-Centered Instructional Strategy

The next step in the Pebble approach is to define an instructional strategy. How can these knowledge components be combined to form a task-centered instructional strategy? A task-centered instructional strategy is best understood if it is contrasted with a more traditional instructional strategy. Figure 7 illustrates an instructional strategy that the reader will have surely experienced during their schooling. In this strategy each topic in a given area is taught in turn. The arrows in the figure represent presentation/demonstration of the information, concepts, and processes included in the topic. Periodically there is a practice or test activity to assess the degree to which learners are acquiring the knowledge

[1] Component Display Theory used more esoteric terms for these relationships. Present Information = *expository generality* (IG), Remember Information = *inquisitory generality* (IG); demonstration = e*xpository instance* (EG); application = *inquisitory instance* (Ieg). Over the years the author has come to adopt the less esoteric terms used in this paper in spite of the fact that these everyday terms often lead to some misunderstandings because of their many connotations.

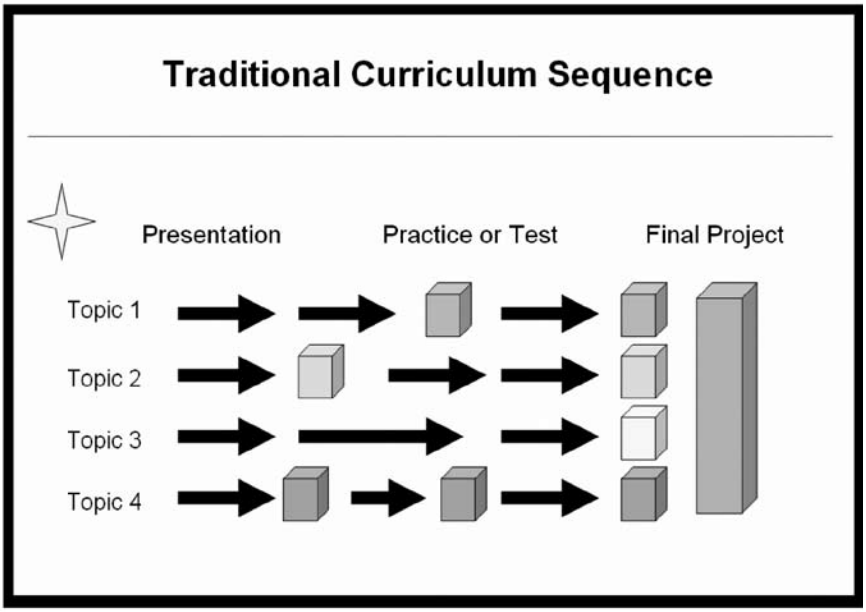

Figure 7: A traditional instructional strategy.

or skill component being taught. After the instruction is completed for the first topic the next topic is taught in like manner. Toward the end of the module or course there is often a culminating experience where learners are required to apply the topic knowledge and skills that they have been taught.

In traditional instruction it is not always clear to learners how this component knowledge and skill will eventually be applied. We have all heard the admonition, "You won't understand this now but later it will be really important to you." How much of such incomplete knowledge have each of us acquired for which we never got to the *later* where this content would be really important. Relevance is a very important component of motivation (Keller, 2007). If a student is unsure of how a given piece of content will eventually be used it lacks the necessary relevance. Acquiring knowledge and skill components out of context makes it very difficult for learners to form mental models about how this information applies in the real world. Acquiring this skill in the context of whole tasks makes it more likely that learners will form mental models for how these individual skills are integrated into a complete performance.

Figure 8 (page 16) illustrates a task-centered instructional strategy. This approach involves learners in the whole task early in the instructional sequence. The sequence of instructional events is outlined in the figure. The instruction starts by demonstrating the first whole task in the progression. This demonstration provides the context for the learners. This demonstration shows the learners what they will be able to do following the instruction. This demonstration forms the objective for the module. Too often formally stated objectives are not comprehensible by learners because they are abstractions of the content. On the other hand learners can more easily grasp a demonstration of the whole task.

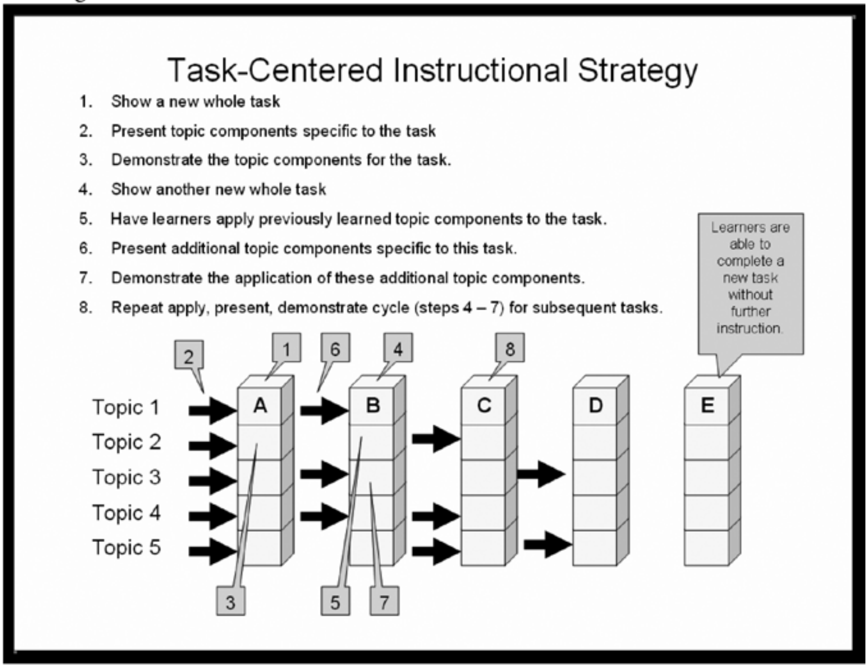

Figure 8: A task-centered instructional strategy.

This first demonstration should be a complete task but it should be the least complex version of the whole task in the progression. While this demonstration should overview all of the components of the whole task it should do so at a high level so as to not overwhelm the learners with details during this initial demonstration.

Table 2 indicates that the strategy for teaching kinds-of requires telling learners the definition, showing examples and non-examples, and having them classify examples and non-examples. The strategy for teaching how-to requires telling learners the steps in the procedure, demonstrating the execution of the procedure perhaps more than once and then having learners do the procedure several times. In more traditional instruction this whole instructional procedure is often implemented for each topic in turn. In a task-centered instructional strategy this strategy is distributed across the several whole tasks in the progression. For the early whole-tasks in the progression the sub-tasks (how-to), the resulting artifacts (kinds-of) with their defining and ordering properties and the procedures (how-to) for creating or finding these artifacts are presented and demonstrated to learners. The application of these skills takes place in subsequent whole-tasks in the progression.

Table 3 illustrates a possible sequence of tell, show and do that might be used for the artifacts and procedures involved for the sub-tasks required to complete each of the tasks. Some components (topic 1) are easily understood and a single presentation/demonstration may be sufficient. Some components (topic 2) may be more difficult to understand and additional demonstrations in subsequent

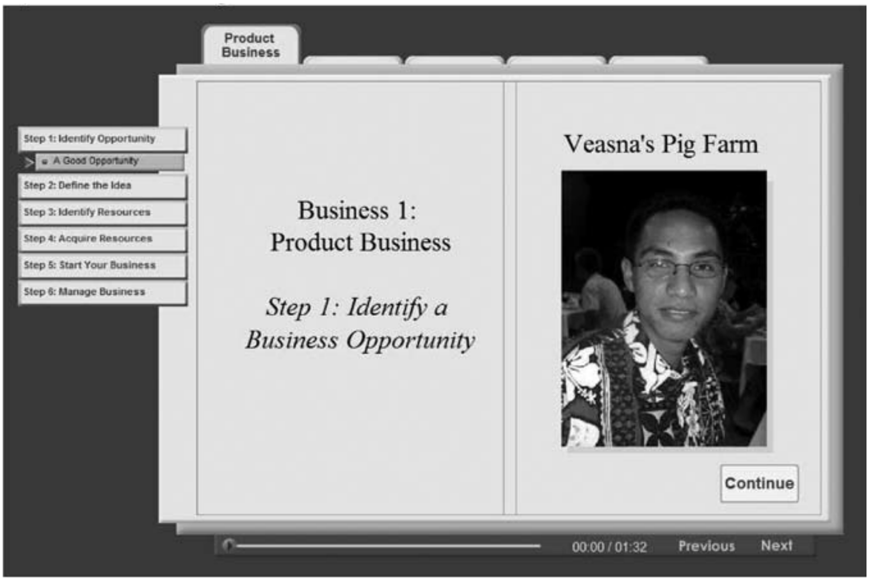

Figure 9: Interface for the exemplar task-centered course.

Table 3: Possible Strategy Sequence for Teaching Components.

	Task 1	Task 2	Task 3	Task4	Task 5
Topic 1	Tell/Show	Do	Do	Do	Do
Topic 2	Tell/Show	Show	Do	Do	Do
Topic 3	Tell/Show	Tell/Show	Show	Do	Do
Topic 4		Tell/Show	Tell/Show	Show	Do
Topic 5		Tell/Show	Do	Do	Do

whole tasks may be necessary for comprehension. Some components (topic 3) may require additional information for subsequent tasks so additional tell and demonstration is required for these tasks. Some components (topic 4) may not be required for tasks early in the sequence and they are introduced (tell/demonstrate) for the subsequent tasks for which they are relevant. Some components (topic 5) may be sufficiently complex that the instances included in the whole tasks are not sufficient to enable learners to grasp the concept or procedure. In this situation it may be necessary to provide additional examples for demonstration or application that are not included in the progression of whole tasks.

A TASK-CENTERED INSTRUCTIONAL STRATEGY FOR THE ENTREPRENEUR COURSE

Figure 9 shows the interface for the Entrepreneur Course. The four businesses used for this course are in the tabs across the top. The six steps for starting a business are listed in the tabs down the left side. Each display had two windows:

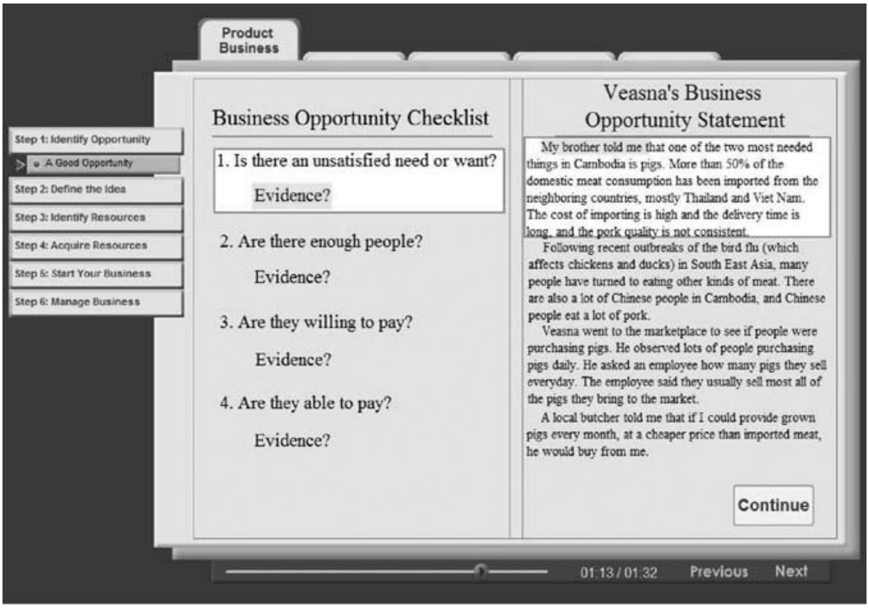

Figure 10: Defining properties and their portrayal.

the information is presented in the left window and the portrayal is shown in the right window.

(1) **Show a new whole task:** After a brief introduction the first business, Veasna's Pig Farm, is overviewed with a short audio/slide presentation. The illustrations are shown in the right window. (2) **Present topic components:** The six steps for starting the business are listed in the left tabs. After the introduction, learners click on the tab for the first step. The defining and ordering properties for this step are shown in the left box and the portrayal for this step is shown in the right box (See Figure 10). Audio elaborates each of the defining properties. (3) **Demonstrate the topic components:** Learners are directed to click on a property to see the portrayal of this property highlighted in the statement of business opportunity shown in the right box. The student can explore and study these properties and their corresponding portrayal as long as they wish. This strategy is continued for each of the six steps for this first task.

(4) **Show another new task:** after learners have completed the presentation/demonstration for the first business, they are directed to click on the tab for the second business, Instant Service Carpet Cleaning (see Figure 11). An audio message briefly reviews and elaborates the defining and ordering properties for this step. (5) **Learners apply:** Learners are then directed to apply these properties to this new statement of business opportunity. The audio provides feedback on their responses to the application. (6) **Additional topic components:** for this new business the audio elaborates the importance of finding customers that are willing to pay. (7) **Demonstrate additional components:** The demonstration of this elaborated property for the carpet cleaning business is described in the audio.

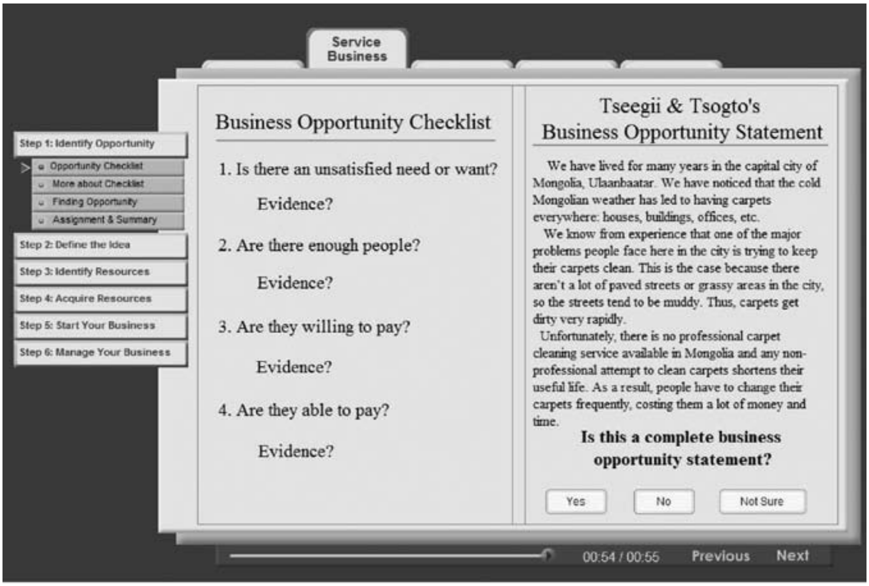

Figure 11: Apply properties to a new example.

(8) **Repeat the strategy for additional businesses.** After learners have completed all 6 steps for the Carpet Cleaning business, they then move on to the retail business and then to the restaurant business. The final application was for students to apply all the steps without further elaboration or demonstration to a fifth business, Kahn Sub.

MORE TO COME

Students in one trial of the Entrepreneur course performed as well on analyzing the fifth business as students who had completed a business major comprised of several topic-centered courses. One student commented that finally for the first time the Entrepreneur Course enabled her to put together the information acquired in her previous business courses. The Entrepreneur course is currently being implemented in several developing countries. There are several other more carefully controlled studies that have directly demonstrated the contribution of first principles of instruction (Frick, Chadha, Wang, Watson, & Green, 2007; Margaryan, 2006; Thomson, 2002). The Pebble approach to development and a task-centered strategy have been implemented in a number of courses following workshops we have presented. I'm unaware of any formal papers reporting the results of these trials but conversations with students in these classes and with the instructors indicate that the students find the courses more relevant, they are more motivated to learn and instructors report that the performance of students in scenario based courses is much better than in previous courses taught by these instructors. Anecdotal data lacks the careful control that I would like to see. Hopefully this paper will provide inspiration for future graduate students or instructors to implement this task-centered instructional strategy and provide us with more carefully collected data on its effectiveness.

Contributor

M. David Merrill makes his home in St. George, Utah. He is an instructional effectiveness consultant, a visiting professor at Florida State University, a visiting professor at Brigham Young University–Hawaii, and professor emeritus at Utah State University. Since receiving his PhD from the University of Illinois in 1964 he has served on the faculty of George Peabody College, Brigham Young University–Provo, Stanford University, the University of Southern California and Utah State University. He is internationally recognized as a major contributor to the field of instructional technology, has published many books and articles in the field and has lectured internationally. Among his principle contributions: TICCIT Authoring System 1970's, Component Display Theory and Elaboration Theory 1980's, Instructional Transaction Theory, automated instructional design and ID based on Knowledge Objects 1990's, and currently First Principles of Instruction. He was honored to receive the AECT Life Time Achievement Award. He and his wife Kate together have nine children and 37 + 2 (by marriage) grandchildren which he claims as his most important accomplishment.

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