not provide first-hand observational information but primarily survey people's contextual opinions or perceptions. In general, survey professionals have cautioned against depending upon questionnaires or surveys without first-hand contextual observation and interviewing (Smith & Kearney, 1994).

Open-Ended Context Questions

Open-ended questions are used in interviews or surveys. Their purpose is to have stakeholders in the context (students, trainers, managers) generate the contextual influences that are most important.

One questioning method is the Critical Incident method. This method is used to generate constraints by having the respondent describe a particularly memorable episode. For example, O'Connor et al. (1984, p. 666) asked an organization's managers to "describe one or two particular instances on the job in which a specific situational condition negatively affected their performance." The responses were grouped into categories that generated types of organizational constraints. These responses can be used to generate a constraints questionnaire (O'Connor et al., 1984).

Other contextual analysts have used similar types of questions. Smith and Kearney (1994, p. 70) use questions such as "If you could wave a magic wand, how would you change your space?" "What difference would it make?" To maintain transfer by developing a maintenance-of-behavior context, Michalak (1981) asked trainees to detail on-the-job obstacles to their performance. To clarify transfer influences, Leifer and Newstrom (1980) used similar transfer-

context questions at the end of training. Such questions can be adapted to identify orienting, learning, or transfer contexts.

Open-ended questions can be used where resources do not permit a more exhaustive contextual analysis. Quickly interviewing several key informants, contextual factors can be identified and explained. One drawback in such questions is that they may be too restrictive: only one or two contextual factors may be discussed (albeit to great detail) and other influential factors ignored. These questions may be used in conjunction with a contextual survey or Pareto Analysis.

Contextual Observation

Observation is a traditional data-gathering tool in needs assessment and other front-end analysis procedures. For contextual analysis, observation involves a tour of the learners' immediate and organizational environment. Designers observe the orienting context to learn more about factors such as social support and opportunity to perform. The instructional context is observed to learn about learner-teacher roles, physical arrangement and comfort. Observations of the transfer context might study support structures, tool needs, and task execution. Yeaman (1983) indicates that only through observation can designers determine how comfortable learners are in environments such as computer-based instruction, and how physical factors such as lighting and seating affect learner performance.

To conduct a context observation, designers visit the different context types and levels, to do an environmental walk-through (Tessmer & Harris, 1992). If resources permit, each con-

Table 4 □ Constraints Questionnaire Examples (adapted from Peters et al., 1985)

Please check the space that best reflects your opinion:							
The *service support* I have to repair X-90 cockpits is							
Unavailable	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Available
Useless	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Useful
My *study group* for the Jasper project is							
Disorganized	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Focused
Tendentious	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Cooperative

text is repeatedly visited. To focus observations, data gatherers may prepare an observational log (Smith & Kearney, 1994). The log contains the contextual factors (and their aspects) that will be studied in the orienting, learning, and transfer contexts. Context observations are frequently accompanied by interviews with the members of the context. Data gatherers may discuss facilitating and inhibiting contextual influences, both physical and social, with the context's students, instructors, clients or managers.

Contextual observations can be generating or confirmatory. That is, goal-free context observations can generate environmental factors to be further investigated by follow-up data gathering. It can also confirm the efficacy of contextual factors that are suspected influences on learning or performance. A drawback is that observation may not be as suitable for the orienting environment or any environment with intangible or pervasive factors (e.g., corporate culture, task attitude). Expert observation may pinpoint contextual influences that participants would not readily identify via Pareto Analysis or questionnaire because they are not conscious of them (e.g., human factors or ergonomics needs, instructor/learner roles).

The Contextual Interview

The contextual interview combines observation with open-ended questions to create a picture of a usage context. This method has been used by computer systems designers for contextual inquiry (Greenbaum, 1993). Contextual inquiry assumes that traditional surveys or interview do not capture the richness of the context of use. It assumes also that many contextual influences are tacit, so that people cannot readily identify them by questioning. Instead, "Design information is present in its richest form when we speak with people during ongoing work or using work artifacts" (Greenbaum, 1993, p. 181).

In the contextual interview, users are observed in the intended context of use (such as a learning or performance context). People (students, teachers) articulate their work as they accomplish it. In this participative design

approach the user, not the designer, is the expert on what contextual factors are important. As such, detailed contextual questions are avoided in favor of open-ended queries such as "What are you doing now?" or "Is that what you expected to happen?" (Greenbaum, 1993, p. 186). These questions allow contextual information to flow from the user and context and less from prepared questions that assume the contextual influences are known.

The outcome of contextual analysis is often a "paper prototype" of the use situation, which can be used for computer systems design. In the instructional design field, this prototype is similar to Tessmer and Wedman's (1995) "design scenarios" concept, used for context-based, holistic instructional design.

Other Tools

There are a variety of contextual analysis tools that have not been detailed in this article. Photographs, diaries, models, maps, and video recordings can depict the context in visual or verbal form (Tessmer & Harris, 1992). These depictions can be used to focus contextual interviews or stimulate contextual design.

Traditional needs assessment tools such as phone surveys, interviews, and focus groups may also be valuable contextual analysis tools. However, techniques such as Pareto Analysis and contextual inquiry are targeted specifically for the elicitation of contextual information.

A CONTEXTUAL ANALYSIS CASE OVERVIEW

In general, the use of contextual analysis alters the traditional orientation to a front-end analysis, design, and evaluation of a given program. This section summarizes a contextual analysis done during the design and development of a workplace literacy program. A major intent of the literacy program is not only to enhance individual skills and careers but also to alter both the on-the-job performance of workers and workplace productivity. With this comprehensive emphasis on transfer of training, it

immediately became clear that it was necessary to enhance traditional design methods to insure success. Consequently, the standard needs assessment was expanded to incorporate the tenets of contextual analysis. The resulting process was seen as a four-part analysis that yielded the following information:

- *Worker Job Descriptions*, including: (a) a clear description of each critical job task, including data such as: component procedures, degree of difficulty, quality criteria, required resources, required skills; (b) a determination of the literacy skills required to be successful with each job task; and (c) projected literacy needs for future hires.

- *Employee Descriptions*, including: (a) general literacy levels; (b) an identification of potential program participants, including information such as cultural and ethnic background, educational level and training experience, work experience, literacy level, English proficiency, current attitudes toward employee training; and (c) past interest and/or involvement in available literacy or language-related training.

- *Instructional Environment Descriptions*, including: (a) a description of existing literacy or language-related instructional programs; (b) an inventory of available instructional materials; (c) an inventory of available instructional equipment; and (d) a description of existing instructional facilities and other types of instructional support available.

- *Organizational Climate Descriptions*, including: (a) an overview of the current organizational climate; (b) a determination of the existing incentives for literacy and/or language learning in each organization; (c) a description of those problems within the organization that are affected by literacy and language deficiencies; (d) a determination of the impact of new technology in each workplace; (e) a description of other existing or anticipated training needs of the organization; and (f) an identification of those aspects of the organizational climate that are likely to facilitate or impede the transfer of literacy and language training.

Such data provided a comprehensive description of the three contextual levels—Orienting, Instructional, and Transfer—and provided the basis for program design, delivery, and evaluation. The precise data collected were based upon research of those factors which impact transfer of training as applied to this one situation. These data then provided program designers with:

- an understanding of the climate into which the instruction was to be embedded, including facilitators and barriers;

- content direction in areas such as needed target skills, needed support for employees in the literacy training and on-the-job supervisors—the hook that would establish program relevance and use;

- direction for constructing the physical instructional environment; and

- the basis for determining program impact at levels beyond immediate skill acquisition.

Diverse data collection procedures were used, including on-site observations, employee and supervisor interviews. The process not only facilitated program design and evaluation but also served to integrate project staff into the plants. Since the instructional designers and program managers were also the data collectors, the contextual analysis process also became a way of incorporating these key persons into the plant life. Thus, the analysis process in effect began to develop program credibility and facilitated subsequent learner recruitment.

CONTEXTUAL ANALYSIS CONCERNS AND DIRECTIONS

This section describes some of the context design issues that remain unresolved, and research issues that warrant further explanation. These issues provide an agenda for further development of contextual analysis and the design of learning and performance contexts.

Learner characteristics

Future design research should explore the learner characteristics that make students more or less sensitive to contextual influences. Preliminary work indicates that contextual influ-

ences depend upon learner characteristics. From a performance technology perspective, Smith and Kearney (1994) stipulate that some workers who are *high screeners* are less sensitive to sound, heat and light. These people actually require environmental stimuli to accomplish less complex tasks. *Low screeners*, on the other hand, are more sensitive to environmental stimuli and require more controlled work or study contexts. In psychology, children who are self-regulated learners may be more resistant to an environment's distractions or temptations (Kuhl & Kraskak, 1994). However, there is little research to date on characteristics that make learners resistant to contextual impediments such as the lack of supervisor or organizational supports.

Context and transfer strategies

The design of learning contexts to facilitate transfer is problematic for designers. The dilemma is whether it is more advantageous to emphasize generalized or context-embedded instruction. Clark and Voogel (1985) conclude that "the extent of transfer is determined, in part, by the amount of decontextualization achieved during instruction" (p. 119). However, the solution is also dependent upon the nature of the learning task and the type of transfer anticipated. It is tempting to conclude that far transfer goals demand generalized instruction, with near transfer objectives favoring a more highly contextualized orientation. An alternative approach is to contextualize all instruction, but to vary design tactics depending on one's transfer goals. In instruction oriented toward far transfer, the emphasis would be multicontextual and directed toward the organizational (or societal) environment, while near transfer goals might be achieved best by emphasizing elements of the immediate environment.

Context-based instructional design models

We see contextual analysis as a missing emphasis within instructional design models,

an approach worthy of its own step or stage. However, this does not mean that context-based design is fulfilled by the mere addition of contextual analysis. Other design activities should reflect a contextual perspective by (if they precede contextual analysis) providing contextual information or (if they succeed it) utilizing contextual analysis. Thus, before contextual data is synthesized, a needs assessment can be used to identify contextual factors; a learner analysis can seek information about screening characteristics and task perceptions. Following the contextual analysis, designers may select strategies that minimize contextual barriers and exploit contextual strengths. The development of instruction will involve development of instructional and transfer supports at learner, immediate, and organizational contextual levels. Contextual analysis is a necessary, but not sufficient, condition for context-based, systemic instructional design.

Context-based instructional design tools

While this paper has outlined the strategies for securing contextual information, there is still a question as to how to best utilize this information for instructional design. In other words, how is the discrete contextual analysis information synthesized?

One possibility is to use the information for scenario-based design. Using an analysis-by-synthesis approach (Tessmer & Wedman, 1995), the design team constructs a visual-graphic scenario of the instructional event (Carroll, 1994; Stuebing et al., 1992; Tessmer & Wedman, 1995), a type of story of the instructional implementation. For contextual design, scenarios would depict the orienting, learning, and transfer contexts. This scenario becomes the basis for front-end analysis, media identification, and strategy selection, as well as a blueprint for prototype characteristics (Tessmer & Wedman, 1995). For scenario-based design, contextual information is a prerequisite; the scenario must depict relevant events of the orienting, instructional, and transfer context as part of the "story" of the learning process.
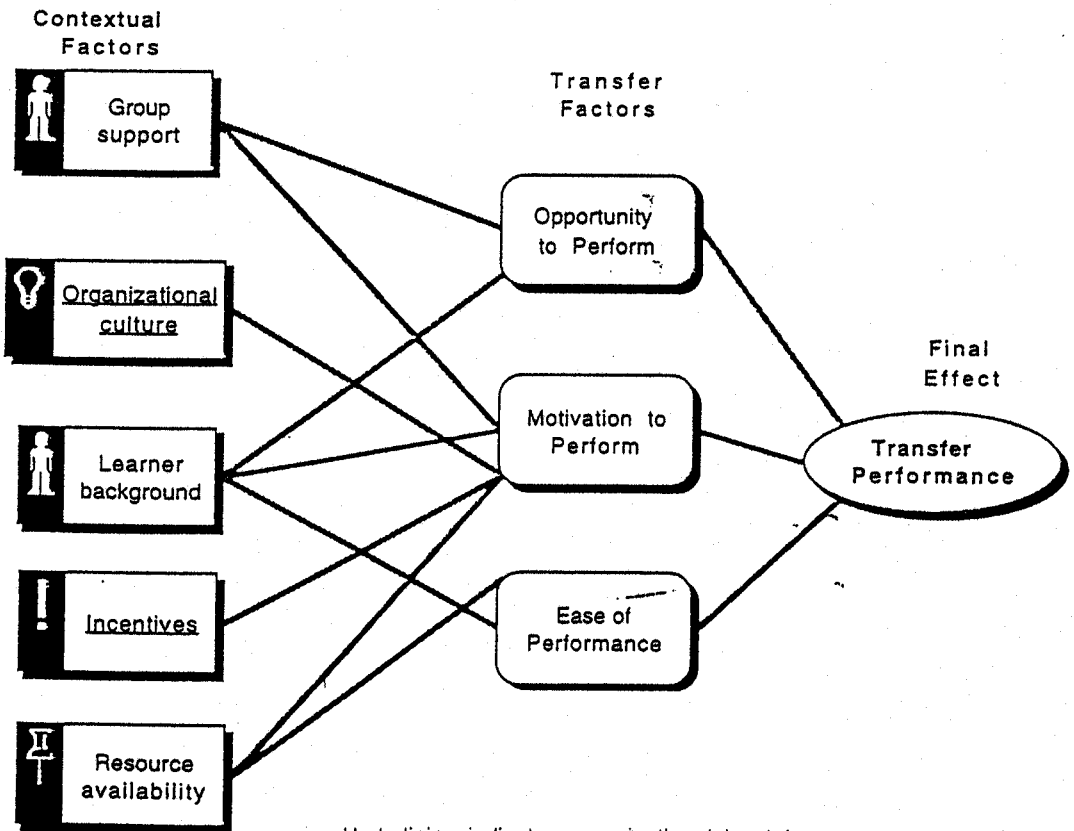
Context factor models

In reading this paper, you may have noticed the apparent interrelationships among factors of different contextual levels. For example, the social support factor of the orienting context's immediate environment may affect the perceived utility factor of the same context. This social support factor may in turn be affected by organizational level factors of the orienting context. On the whole, however, the relationships between a context's factors, and their conjoint effect upon learning and performance, remains uninvestigated.

Current research has identified potentially influential contextual factors, but there is insufficient data to support the causal relationships between them. The majority of such relational work is upon the transfer environment. Using the tools of factor and path analysis,

organizational researchers have attempted to model the relationships between basic and intermediate transfer factors, and their relationship to transfer performance (e.g., Clark et al., 1993; Tracey et al., 1995). For example, using factor analysis and stepwise regression, McDonald (1991) isolated four primary factors (of 20) that predicted back-to-work training use: personal attitude, external agency approval, personal competency, and administrative commitment/follow through.

The accumulation of relational research would allow for factor-based models of orienting, instructional, and transfer contexts. As an example, a rough summary model of transfer research is depicted in Figure 2. These would be "suggestive" models: for designers they would suggest the basic contextual factors that warrant their investigation and design, and the secondary factors that are affected by

Figure 2 ☐ Transfer Context Factors Model

Underlining indicates organizational level factors

them. Initial models have been proposed by Richey (1992) and Quinones et al. (1995). Anderson et al. (1997) have suggested a cognitive methodology for analysing social context factors.

SUMMARY

Context is a multifarious and complex force in every learning and performance enterprise. All instruction is embedded in context, and context can be designed to exploit contextual resources and mitigate contextual restraints. Be that as it may, the instructional design literature contains precious little information on how to identify and accommodate context.

We have proposed a general model for contextual analysis for instructional design. The model identifies contextual factors to be investigated, delineates contextual tools to explore these factors, and suggests a general approach to utilizing this information for instructional design. The central assumption behind the model is that there are three contexts that must be investigated (and designed) for successful instructional development: the orienting, instructional, and transfer contexts. Each of these contexts has several different levels, with contextual factors within each level. The importance of the contextual factors will vary with training or teaching setting, but all warrant initial consideration.

We view our contextual analysis model as an important step in developing context-sensitive instructional design models (Richey & Tessmer, 1995; Tessmer & Wedman, 1995). Obviously, other contextual factors and tools will be added to our model, as designers react to its tenets. We see contextual analysis as part of a growing contextual movement in education: exemplified in contextual research (e.g., case research), contextual learning (e.g., situated learning), and context-based design. □

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