DIAGNOSING PROFESSIONAL LEARNING ENVIRONMENTS:
AN OBSERVATIONAL FRAMEWORK FOR
ASSESSING SITUATIONAL COMPLEXITY

by

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Submitted to the Alfred P. Sloan School of Management
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ABSTRACT

This study develops a model of graduate-level learning environments from
which differences in learning situations can be identified in a form com-
mensurate with individual differences so that meaningful statements can be
made about the consequences of learner-environment interactions. The spe-
cific site studied to develop the model and observational scheme was a de-
partment of landscape architecture within a graduate school of design.

Four distinct orientations of learning environments were hypothesized based
on existing theory and empirical research: affective, perceptual, symbolic,
and behavioral. These environmental orientations were viewed as differing
in terms of five characteristics that were, in theory, predetermined and
independent of student behavior in the environment. These were the in-
tended purpose of major events or activities, the principal source or focus
of information used, the potential for feedback, the nature of the teacher's
role, and rules or guidelines governing learner behavior. Preliminary ob-
servation led to the development of a twenty-one item observational tool
to measure the extent to which a given course was affectively, perceptually,
symbolically, or behaviorally oriented.

Ten courses were measured using the observational tool, resulting in pro-
files for each course. These profiles were compared with student percep-
tions of these courses based upon the same variables. The results indicated
basic agreements between observer measures and learner ratings and repre-
sent the major findings of this study.

Learners were typed according to the Learning Style Inventory. The learners' satis-
faction with and perceived value of their courses were then studied.
Generally, "Active" and "Concrete" learners preferred Behaviorally oriented
situations and "Abstract" and "Reflective" learners preferred Symbolically
and perceptually oriented courses. Specific indicators of the major pur-
pose of activities, primary source of information, and potential for feed-
back were related to certain types of learners in predicted fashion (e.g.
active learners preferred behavioral environments characterized by activities
designed to apply knowledge and skills to practical problems). Indicators
of teacher roles and rules guiding learner behavior did not differentiate learner types as predicted. Most learners sampled preferred supportive teachers who demonstrated professional competence and gave personalized feedback on learner performance.

The findings generally support the thesis that learning environments vary along dimensions that are primarily predetermined and independent of learner interaction in the setting. There is also support for the four-space model of environments wherein any course can vary in the degree to which it is oriented in four areas. A revised model is presented depicting these areas of orientation: 1) Behavioral-simulative; 2) Symbolic-mastery; 3) Reflective-investigative; and 4) Affective-self-analytic.

Thesis Committee Chairman: Edgar Schein
Professor of Organizational Psychology and Management
Chairman, Organization Studies Group
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DIAGNOSING PROFESSIONAL LEARNING ENVIRONMENTS:

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ENVIRONMENTAL COMPLEXITY

INTRODUCTION

Two second-year students in a graduate school of design, majoring in Landscape Architecture, are leaving a seminar room with the author. The seminar that has just ended is a weekly session where noted practitioners in the field of Landscape Architecture are invited to lead a one and a half to two hour presentation and discussion on a topic or project of their choice. One such session has just ended and the following conversation takes place.

Author to Student A: "Well, how did you like that session?"

Student A: "Pretty good. He was a sharp guy. I liked the way he handled himself, you know, thinking on his feet. He had some good answers to our questions."

Author: "He did seem like a pretty dynamic character."

Student B: "Yeah, he was really interested in that project, and that seemed to turn on most of the audience. I was glad to hear someone in the field be clear about his business values, as well as his aesthetic values, for a change."

Author: "What do you think you got out of the session?"

Student A: "That's a little hard to say. I certainly know more about him and his work. He gave me a lot of insights about what it's like to work in a business like his. I guess he also confirmed what I already suspected, that you do have to compromise all the environmental, consumer, and nature-oriented values you hear in school with the hard facts of economics and politics."
Author to Student B: "How about you? What did you think of the class?"

Student B: "It was o.k. He was a little too showy for my tastes, but he did seem to know what he was talking about. Some of these guys just come in here and fill the room with hot air. I think he did have some important things to say. The kind of project he is undertaking is certainly worthwhile. I think we should hear from more people like him, working on large-scale site development plans, instead of these ones we've been getting who do a fancy building or plaza."

"His discussion of the variables he considered most crucial to the site plan were interesting in comparison to the ones we're using in our _______ course. We're working on a relatively similar problem, but we're using a computer model to look at the effects of changes in the variables we're looking at. I think his work could have benefitted from an approach like the one we're using. But his presentation was certainly more complete and informative than the one last week."

Author: "What about the discussion during the last half hour. Was that valuable?"

Student B: "To tell you the truth, I started thinking about what I'm going to do this afternoon on my site plan for _______. Most of the questions that get asked are pretty stupid, I think. If you ask a real Landscape Architect if he values the environment, of course he'll say yes, but it's obvious he has to make a buck too, so obviously he compromises a lot more than I'd expect him to stand up and say here."

Author: "Anything of value you think you learned from this session?"

Student B: "Sure. The fact that he sees relatively the same variables as important in the site plan as we do, using our computer model makes me more confident that computer modelling is the way to go in the future."
These differing reactions come from two peers, both doing well in their professional studies, and both having just experienced the same class session or environmental situation. While both would probably rate the session highly, their reasons would differ. One (B) prefers the lecture presentation for its content while the other (A) profits from viewing how the presenter handles himself. Further, they appear to have learned different things: attitudes/values on one hand (A) and methods on the other (B).

What theories, models, or concepts do we have to explain these kinds of outcomes? Are teachers and administrators aware that a particular class or course design can lead to multiple results like these? If one wanted to produce either or both of these kinds of results from a learning experience, how would they go about it? These are just some of the questions raised by a short interaction like the one above. This study attempts to begin to answer these kinds of questions and issues. The basic assumption of this author is that our current models of learning environments are too general. They oversimplify interactions between learners and their environments so as to be almost useless to the teacher or administrator. The question, for example, should not be whether the lecture was more helpful than the discussion, but rather what, in particular, about either attracted the learner's attention, motivated him, or rewarded him. As Cronbach (1975) recently argued, we need to strive for more "interpretation in context versus generalization across contexts." Thus we should seek to understand the complex interactions within a particular environment rather than try to simplify and generalize across all educational situations.

The basic purpose of this study is to further our understanding of
the teaching-learning process in professional education. More specifically, the study will attempt to develop a new model of learning environments using a course as the unit of analysis. The model will posit a set of factors or environmental variables that should relate to individual learning styles in more meaningful terms than to the present conceptions of learning situation (i.e. lecture versus discussion, teacher-centered versus student-centered). In other words, the model of learning environments developed here will attempt to take a typical environmental setting like the seminar described above and specify those elements or factors within that setting that students A and B each reacted to or enacted with to produce the outcomes elicited in the discussion reported above.

Based on this new model of learning environments, the major contribution of this effort is intended to be an observation tool to be used to diagnose or measure learning environments along dimensions commensurate with different individual learning styles. Comparing observer measures with student perceptions and the actual testing for person-environment interactions in a professional education setting will serve as a validity test of this observation instrument and the theory underlying it. Hypothesized interactions or "matches" between these learning styles and measures of environmental complexity that lead to higher learning outcomes or more learner satisfaction will be investigated. If one type of learner style is shown to react with a type of environmental situation to produce more learning or more satisfaction than another style, or than that same style with a different environmental factor, a "match" or interaction will be said to exist.

The ultimate goal of this kind of inquiry into the teaching-learning
process is to become more cognizant of all the various and surely complex interactions that can exist between learners and their environments. Then educators and learners would be in a position to design and manage the most effective learning situations possible. The specific goals of this study are less ambitious, but nevertheless necessary as a start in the proper direction. The hoped for outcomes include:

(1) a new model for viewing learning situations or environments, particularly at the professional level, that is commensurate with learning theory and valid based on the empirical part of this study;

(2) validation of the concept of environmental "complexity": that any single course or class session can be, in fact, many things to many people. As in the discussion with Students A and B, for example, the same event can appeal abstractly or intellectually to one and very concretely or personally to another.

(3) some evidence of person-environment interactions in terms that would enable a teacher, for example, to better understand what it is about a lecture that is appealing to one kind of student and not to another. It is necessary to note in this context that this study does not attempt to suggest what, or if, matches between persons and environments ought to exist. This is a much more specific question we are not prepared to study at this point in time. It may well turn out that a "comfortable" match (Person X Environment = Satisfaction) is not the best for learning or personal growth. In order to decide on this question, however, we must first know something about what matches do
exist and how to measure persons and environments to detect them.

Finally, it is anticipated that this study will, at the very least, leave us in a position to formulate better research questions about teaching and learning in professional education: how to differentiate amongst professional level learners; how to view the environment; which "matches" produce growth versus satisfaction, or both?
CHAPTER I

Rationale and History Underlying the Study of Learning Environments in Professional Education

The assumption behind this study and the research questions addressed in it are best understood after a review of the growth and development of the concept of "learning environment." From the start, it should be noted that no singular concept called learning environment actually exists. The setting, context, space, etc. in which people learn and people teach has been studied from numerous perspectives. Relevant literature to this subject or concept comes from studies and essays by researchers of education, social psychologists, sociologists, cognitive theorists, organizational theorists, group trainers and anthropologists. Their methods and units of analysis vary from item analyses of taped dialogues in classrooms to laboratory experiments with groups to survey analyses of campuses involving thousands of respondents. This chapter will present a review of related lines of inquiry and findings from these various perspectives. Given the seeming myriad of ways of viewing learning environments, the summary that follows is not as inclusive as it is integrative. And it is from this attempt to integrate different approaches to studying learning environments that the formulation and principles underlying this study are derived.

Early Notions of Learning Environments

Often referred to as "black boxes" (e.g. Dubin and Taveggia, 1968), learning environments were first referred to quite indirectly, if at all, through efforts to assess teacher effectiveness. In analyzing numerous studies from 1920-1930, Withall and Lewis (1963) conclude that the central
criterion for measuring teacher performance was the simple assertion as to whether or not the teacher retained or lost his job. Thus, a "good" learning environment, or classroom in these cases, was implied to be whatever the "good" teachers did. Although criteria for teacher effectiveness were expanded to include achievement test scores by students, superintendent ratings, and scores on sophisticated measures of teacher traits, any results in terms of understanding learning environments were disappointing. Barr (1935) concluded that these kinds of variables were overshadowed by more complex phenomena like interpersonal style and teacher-pupil interactions. Social psychologists were also reaching similar conclusions. Thomas (1929) and her colleagues attempted to chart and record social interactions in classroom settings. One key assumption about learning environments that lay behind these analyses was that the main direction of influence in the teaching-learning process was from teacher to pupil. The result was a period of investigation of teacher-pupil interaction, focusing on the categorization of teacher behavior and statistical refinement of observation schemes (e.g. Anderson et. al., 1946) for categorizing teacher behavior.

The teacher-centered focus was further influenced by Lippitt's (1940) landmark study of the effect of social climate and leadership roles on group life and productivity of four boys' clubs. The clear impact of leadership style on group life had definite implications for teaching. Lewin, Lippitt, and White's subsequent work on the interpersonal interactions of children in differing social settings also introduced the notion of a "socio-emotional climate" to educational researchers. Stern (1963) notes that this and the introduction of Rogerian, nondirective
counseling (1942) laid the groundwork for a new orientation toward learning environments. This was characterized by more learner-centered assumptions regarding the classroom. Thelen, Withall, Flanders, and Glidewell at the University of Chicago sought to develop integrated theories of instruction, combining concepts from Rogers and group dynamics. Their focus was on determining the learner's relationship with persons and objects in the classroom (Thelen, 1951). The classroom was now seen as a social milieu where instruction (teacher-centered) and learning (learner-centered) took place. Thus the interactive nature of learning environments became a focus for study.

For reasons that are unclear, however, the understanding and analysis of person-environment (P-E) interactions in education settings did not become the central line of inquiry in the 50's and 60's. Perhaps in an attempt to simplify the complexity of such a paradigm, what developed was study after study trying to determine which kind of pedagogy or which type of teacher style was best. Dubin and Taveggia (1968) analyzed the raw data from 91 studies from 1924-1965, comparing lecture to discussion, teacher-centered to student-centered climates, and autocratic to democratic teacher styles. They found that:

These data demonstrate clearly and unequivocally that there is no measurable difference among truly distinctive methods of college instruction when evaluated by student performance on final examinations, (p, 35)

Milton (1972) notes similar findings by Macomber (1957), who studied 4700 college students, and Stern (1963), who summarized 34 classroom studies.

Suggesting a redirection in studying learning environments, McKeachie (1963) noted that in 19 cases from Stern's samples of studies where
students were asked their opinion of student-centered environments, nine studies showed favorable student opinion, five showed mixed degrees of satisfaction, and four actually reported negative satisfaction. McKeachie's conclusions were twofold:

1) There were problems in the definition and measurement of "student-centered" climates;

2) The results indicated the need to view students as having different needs and goals, regardless of the climate they are subjected to.

While this focus on comparing pedagogies has succeeded in convincing current educators that lectures are not the only means of teaching, it appears that little else was, in fact, added to our understanding of what constitutes an effective learning environment. Rather, what is apparently lacking is a model of learning environments that is "complex" enough to be useful in situations where different kinds of learners can realize their needs, or learn different things, in the same setting. Conversely, environments cannot be viewed as either lecture or discussion oriented, but possibly a mixture of characteristics which enables similar learners to learn different things or different learners to learn a similar thing.

Macro Notions of Learning Environments

The relationship between student needs and educational "climates" was pursued by Stern (1962) and Pace and Stern (1958), who developed survey instruments to assess student needs and college characteristics. Their intent was to validate Murray's (1938) psychological paradigm that says performance is a function of congruence between individual needs and environmental presses. The resultant College Characteristics Index (CCI) proved
useful in comparing general attributes across campuses, but did little to either validate the needs-press theory or to explain any student behavior. In fact, McFee (1961) found in one campus no evidence of a systematic relationship between individual needs and their perceptions of college press using the CCI. Astin and Holland (1961) developed an Environmental Assessment Technique which was validated against the CCI and found some aggregate relationships between attributes of a student body (aggregated need scores) and perceptions of college environment press (aggregated scores of perceived characteristics of the faculty, curriculum, physical environment, etc.). Although useful in describing and comparing general campus environments, these studies contributed little to any further understanding of P-E interactions in learning environments.

Litwin and Stringer (1968) were able to use the "climate" construct to learn more about P-E interactions in their laboratory experiment modeled after Lewin, Lippitt, and White's classic boys' clubs study. Using six climate or environmental dimensions (i.e. structure, responsibility, risk, reward, support, conflict) they artificially created three different working group environments by varying leadership style. Then they analyzed group task performance, individual satisfaction, and individual need arousal over a two week period. They concluded that, once created, these climates had significant effects on motivation and correspondingly upon performance and satisfaction.

**Group Dynamics in Classroom Environments**

Building from Litwin and Stringer's work and from the growing body of research in group dynamics (e.g. Cartwright and Zander, 1968) and the study of discussion methods of teaching (Abercrombie, 1970), Anderson
(1968, 1973) has developed and tested a Learning Environment Inventory (LEI) to assess classroom social climates in primary and secondary schools. His basic premise is that the classroom should be viewed as a group and that valid group properties from related research and theories can be used to differentiate between classrooms, as well as to account for differences in learning between classes. The LEI contains 105 statements which student rate on a 4-point scale. These statements have been factor analyzed into 15 statistically independent dimensions. Anderson (1973) reports that eight of his scales, namely cohesiveness, environment, friction, cliqueness, satisfaction, disorganization, difficulty, and apathy do account for substantial variance in measures of student learning.

In addition, the LEI was found to be a valid predictor of cognitive, affective, and behavioral learning when compared to standardized I.Q. tests. In three studies (Anderson and Walberg, 1968; Walberg and Anderson, 1972; Walberg, 1971) analyses of variances showed that I.Q. generally accounted for up to 16% of the variance in learning measures, while the LEI scales mentioned above accounted for 13%-46% of the variance. These results are encouraging, on the one hand, because they actually demonstrate the impact of group effects upon class mean scores on learning measures. But to answer, "how does an individual student's perception of his learning environment affect his learning," one has to compare individual classroom climate ratings with measures of individual learning. The bulk of the research done prior to and including Anderson's, however, suggests that measures of classroom climate are essentially group factors to be compared with other groups. This leads to analyses of class mean scores on climate factors as they relate to learning outcome measures by that class,
as a whole. These mean scores are then used in comparative studies across classes. It should be noted, however, that class mean learning scores are not readily transferable to individuals. In some cases the effects are transferable, but not necessarily. In fact, Anderson's own data on 1048 subjects in 65 classes shows standard deviations for individual means on each LEI dimension (total sample) to be much greater (at least twice as large in 12 of 15 cases) than the corresponding standard deviation of class mean scores for that dimension (Anderson, 1973). Hence, a lot of individual variance, which could relate to outcome measures is not explained by perceived climate scores aggregated by class. This suggests the need to view learning environments in terms other than, or in addition to, the group-effect kinds of constructs studied by Anderson. While the group dynamics acting in a classroom situation do appear to account for some variance in learning, Anderson's data also seem to underscore the need to identify other factors, perhaps not related to the social psychological climate of the class, to help explain P-E interactions.

Aptitude-Treatment Interactions

Along with the college needs-press studies (e.g. Pace and Stern) and classroom interaction analyses (e.g. Anderson), Mitchell (1969) includes Aptitude Treatment Interaction (ATI) analyses as an area of study attempting to understand person-environment interactions in learning situations. Here, individual differences, as opposed to group characteristics, are taken into account. A typical ATI study is a two-group experiment. A measure of learning outcome is regressed onto a score recorded prior to a treatment. If the resulting regression lines from the two groups (e.g.
high trait group versus low trait group) differ in slope, this is said to be evidence of an Aptitude X Treatment Interaction (Cronbach, 1975).

In Cronbach and Snow's (1968) report on the state of ATI research, they state the goal in terms of the individual learner:

In what means do the characteristics of learners affect the extent to which they attain the outcomes from each of the treatments that might be considered? Or, in considering a particular learner, which treatment is best for him? (Page 4)

Unfortunately, this attempt to allow for individual differences in learning situations has not led to new model of environments. Few, if any, significant interactive effects (ATI's) have been found (Hunt, 1973). Bracht (1969) reviewed 90 articles, reporting studies of personological and environmental variables and concluded that five produced meaningful (statistically significant) interactions. In two of these five studies, the aptitude measure involved personality characteristics, while the other three reported significant interactions between level of anxiety in the individual and certain treatment variables. Although Hunt (1973) argues that the statistical definition of an "interactive effect" is too limiting, he and others seem to agree that this, alone, would not change Bracht's general findings. Cronbach and Snow (1968) concluded that personality traits as measures of individual aptitudes are insufficient. Cronbach (1975) has more recently argued to let an "aptitude" be defined so as to embrace any characteristics of the person that might affect his response to a treatment. The implication for this study is similar to that previously discussed concerning the analysis of environmental factors: there is a need to find new or more appropriate variables to differentiate individuals that are directly related to what we are trying to
measure (learning). Glaser (1972) takes such a focus regarding ATI studies and argues for new aptitude measures which are person characteristics that describe differential susceptibility to educational environments. Bracht (1970) also faults past ATI research as being nearsighted in that experimenters usually identified alternative treatments first, and then, by trial and error, sought to find personological variables to interact with treatments. He concluded that until alternative treatments (environmental measures) and personological variables were both defined and measured with the ATI paradigm, or some other linking theory in mind, little success should be expected.

The "Structure" of Learning Environments

Hunt (1971, 1973) has tried to put the ATI critics to rest. Specifically designing his studies with Lewin's classic B = f(P,E) paradigm in mind, he and his colleagues have sought to discover meaningful P-E interactions, primarily in secondary-level education: Upward Bound Projects (Hunt and Hard, 1967), 147 Grade 9 students (Hunt, 1971) and 180 Junior High School students (Hunt, 1971). The personological variable (P) is the learner's cognitive orientation or Conceptual Level (CL) which is measured by six paragraph completions (e.g. What I think about rules...; When someone disagrees with me...). Responses are coded (Hunt et. al., 1968) and a CL scores is calculated. The CL index has been correlated to standard intelligence tests, academic achievement scores, and personality variables (Kohlberg moral maturity scale, Loevinger scale of ego development, etc.). Educational treatments (E) are differentiated according to their degree of "structure" which is derived from the Schroder et. al. (1967) construct of
"environmental complexity". Although specific criteria for measuring degrees of structure are vague, they also appear to implicitly follow from Schroder et. al.: information load, informational diversity, rate of information change, amount of punishment and amount of reward. The measurement of these factors is subjective resulting in general distinctions between low structure treatments like the "discovery approach" or "independent study" and high structure treatments like lectures or teacher-centered question and answer sessions (Hunt, 1971). There appears to be a need for more refined, objective means of measuring environments under this scheme, perhaps in a way that can be validated against student perceptions of the same environment (Kolb and Fry, 1975).

Hunt's basic thesis is that low CL learners need, and hence do better in, high structure environments, while high CL learners can do well in either, but prefer (and do better) in low structure environments. Hunt (1971) cites numerous studies to support these general hypotheses, most notably McLachlan's (1969) study of high and low CL students in lecture versus discovery oriented art appreciation classes; Tomlinson's (1969) study of the different effects of rule-example ordering on low and high CL students trying to learn Festinger's principle of "cognitive dissonance:" and Tuckman's (1968) study of the interactive effects of learner CL with nondirective teachers (low structure) and directive teachers (high structure). The CL construct thus appears to be a valid and meaningful way to differentiate learners and study P-E interactions. Like the construct of "structure," however, CL may be too encompassing in that it represents several theoretically based, but interdependent, factors: motivation, cognitive abilities, maturity, value sophistication, etc. If there
were a way to measure each of these and then relate them to environmental factors, more meaningful P-E interactions ought to result. Hunt (1973), himself, suggests this as a new direction in his work. He envisions a profile of a learner based on "accessibility channels" which make up that person's CL. These would be the learner's cognitive orientation, motivational orientation, value orientation, and sensory orientation. Kolb's (1971) Learning Style Inventory similarly differentiates the learner's conceptual (abstract) orientation, behavioral orientation, concrete orientation, and perceptual orientation. In either case, the objective should be to define and measure environments in terms commensurate with the above kinds of individual variables which would have been shown to be related to how one learns. Hunt's findings would indicate that when this is done, some meaningful statements can be made about the expected effects of a particular environment (i.e. high in structure) upon a certain type of learner (i.e. low in conceptual complexity).

"Matches" in Person-Environment Interactions

In order to better understand person-environment (P-E) interactions in educational settings Hunt and his colleagues have sought to discover "matches" or fits between personological variables and environment measures that produce a desired effect, similar to Murray's classical needs-press theory of individual behavior (Hunt and Sullivan, 1974). A "match" between P and E can occur for different reasons. A match or fit between a learner attribute and environmental factor can be "compensatory" in that the subject is learning because the environment is supplementing his skills in order to accomplish a meaningful task, exercise, etc. Or, the match can be "preferential" in that the environment supports and arouses
those skills, attributes, etc. which the individual likes to use and/or excels in using. Theoretically, causality in a P-E interaction can be in either direction. The educational research discussed in this review has tended to focus on the E → P part of the relationship in attempting to discover the effects of teacher style, group leadership style, etc. upon learners. This may be valid for mandatory or compensatory education. In professional environments, however, where learners have selected one field over another, one might expect more impact on the environment by the learners themselves. In choosing amongst courses, amongst project or thesis topics, amongst faculty role models, or amongst possible sites for "apprentice-type" learning, the professional learner is continuously selecting, experiencing, and selecting again, based on that experience. Regardless of direction of causality, it would seem that the discovery of P-E interaction, per se, would enhance our understanding of what kinds of environments help or hinder which type of learner in acquiring some learning outcome.

Studies of creativity and of the cognitive styles of professions also support the notion that fits or matches do occur and that if we understood exactly what it was that was "matching up," we would know much more about the process of learning. Hudson's study of English schoolboys, for example, demonstrates clearly that people identical in measures of I.Q. nevertheless have distinct differences in how they respond to open-ended tests, depending on whether or not they have been in or self-selected into arts versus science-oriented studies (Hudson, 1966). While surprised that his open-ended tests did not reflect degrees of brightness across his pupil sample, Hudson did conclude that his tests were in fact one of his
best correlates of the art-science distinction. He further hypothesized that the "divergent" and "convergent" minds that tend to be found in the arts and the sciences, respectfully, are formed early in and matured during adolescence. While this may be partly the case, there is evidence as well to indicate that the educational environments are causal factors in forming and/or attracting certain types of individuals, thus producing P-E "matches." Roe's (1953) findings of the contrast between a concern with people and a concern with things amongst psychologists on the one hand and anthropologists on the other suggests that, at the very least, professional learning environments served to accentuate certain individual differences in these cases. Plovnick's study of physics majors also indicates the causal aspects of professional level learning environments. Using Hudson's concepts, he found that physics majors whose style (convergers) fit with the hypothesized convergent demands of the physics education at his test site were more certain about enrolling in doctoral physics programs and took less courses outside of the physics department than their divergent colleagues (Plovnick, 1971). Further evidence of the matching process or P-E fitting in professional education appears in Kolb's study of M.I.T. seniors in twelve departments. He compares the mean learning style scores of all seniors in a department with the mean style score of those planning to enter graduate school. The prediction that those planning to go to graduate school would "fit" better with the apparent demand characteristics of the department or subject area held true in six of twelve cases (chemical engineering, mechanical engineering, management, humanities, economics, and mathematics) (Kolb, 1973). These results are encouraging, given the rather primitive and general methods
currently available to measure environmental demands. What is needed is a model of learning environments and refined measurement tools to assess the predominant characteristics of such departments as architecture, biology, earth sciences (which were among Kolb's six "nonfits") in their specific setting, such as M.I.T. in Kolb's case.

Summary: Toward a New Perspective on Learning Environments in Professional Education

It has been noted that the early and dominant trend in research on learning environments has been to focus on the socio-emotional "climate" or individual variables such as motivation, attitudes, participation, liking for the teacher and social isolation. Many of the variables have been shown to be important. However, findings related to the measurement, design, and implementation of more, versus less, effective learning situations as a result of this research have been minimal. Underlying this trend seems to be an implicit assumption that a "learning environment" is predominantly determined or defined by the interaction that takes place between students or between students and teachers. The more recent focus on P-E interactions and on finding fits or matches between person variables and environmental characteristics suggests a different view. This is that a learning environment might be more productively viewed in terms of its impact upon the learning process and styles of teachers and students rather than as a result of those processes. The major assumptions emanating from this perspective, with particular emphasis on the implications for professional education are summarized below.

1. Professional learning environments are primarily predetermined and are therefore characterized by factors which
exist regardless of the quality of student-student or
student-teacher interaction.

The emphasis in past, "climate-oriented" research on what goes on
between individuals or in groups in a learning situation overlooks aspects
of the environment which were designed and imposed before any interaction
takes place and remain or continue on afterwards. This does not belittle
the useful factors found in Anderson's Learning Environment Inventory or
in Litwin and Stringer's experiments with different socio-emotional cli-
mates in groups. It does, however, put them in perspective by implying
that more meaningful descriptions and predictions about learning environ-
ments may result from viewing them as more predetermined (though not
necessarily consciously) than dependent. The fact that certain things are
learned from objects (books) or media without any social interaction with
teachers or peers supports, at least, the consideration of factors other
than those typically studied as making up the social climate of an en-
vironment.

While suggesting that learning environments consist of independent
factors or exist, in a sense, before students are actually in them, this
does not mean that they are final. They can be stable or what has been
called "student-pull" or they can be unstable and greatly modified by
those who are in them, affected by what has been called "student-push."
The view of learning environments posited here, however, would say that
this stability-instability or degree of flexibility is more a predeter-
mined characteristic related to the teacher, subject matter, professional
norms, expectations of students in general, etc., than a random occurrence
brought about by the particular "chemistry" of a given class group.
2. Learning environments must be characterized in terms commensurate with individual differences in learning styles so that meaningful statements can be made about the consequences of P-E interactions.

Regardless of the boundaries placed on the units of environmental analyses, we must deal with the issue of what to study within these units. It has been suggested above that a certain type of factors be considered in formulating a model of learning environments. The validity of any factor posited can best be determined by finding evidence of an interaction between that environmental variable or construct and a learner, or type of learner, that produces a desired effect. Hunt's successful use of Lewin's $B = f(P,E)$ paradigm to find P-E "matches" comes closest to our interests here. Such interactions between the person and the environment cannot be examined usefully unless both are being measured in analogous terms. Thus learning environments must be viewed and measured in terms or upon dimensions that learners are also expected to vary upon and that relate specifically to learning theory. Two specific implications follow from this:

a. Environments must be viewed in terms that learners perceive them.

A basic assumption behind the exploration of a P-E interaction is that the individual (P) is aware of some environmental factor (E) as having had an effect upon him (Hall, 1971). Thus we must strive to understand environment in the way learners perceive them. Van Maanen (1977) suggests a similar challenge to the study of organizations. He argues for a more problematic focus (i.e. discovering what it is that influences
the individual...from his perspective) rather than the more orthodox managerial or output-oriented studies where the concern is for outcomes or results to better enable structural or managerial control of individuals. A major thrust of this study will be to develop a model of professional learning environments that fits with student perceptions of these environments.

b. In analyzing P-E interactions, learners (and hence environments) must be conceptualized in ways that relate to a pragmatic learning theory.

The ATI studies discussed earlier posed a dilemma because even though individuals were differentiated according to various personalological variables, no meaningful P-E relationships emerged. Thus an implication for this study is that individuals (learners) must be differentiated in terms of traits, characteristics, skills, etc. that are related to a pragmatic learning theory: some notions about how basic aspects of a learning situation like lesson design, teacher behavior, nature of information, etc. interrelate with learner behavior to produce learning. Tallmadge and Shearer (1971) note that nearly all research in the learner characteristics-instructional method pairings area has employed measures of individual differences developed for specific applications other than learning. Hunt's success with his matching model may stem primarily from the fact that his learners are "typed" according to a construct (level of "conceptual complexity") that is directly related to a commonly shared educational goal: the manipulation and assimilation of abstract concepts, symbols, thoughts, etc. Thus, when he discovers environmental treatments relating to differences along this dimension, he is in fact beginning to
diagnose environmental factors related to learning.

3. Models of professional learning environments must account for the complexity of learning goals and various means by which they can be attained.

Although this summary has focused mainly on issues concerning person-environment interactions, it is essential to keep in mind the question, "for what purpose or goal?" Dubin and Taveggia (1968) point this out in their summary of 91 studies comparing teaching methods. They found that in the two studies which showed one method to be superior to another on a measure of knowledge of subject matter, both studies favored the lecture method. In the six studies which showed discussion methods superior to lecture, the performance measure was other than final examinations testing knowledge. The implication here is that one must differentiate amongst learning outcomes, and other educational goals, in order to begin to understand P-E relationships. Harrison (1969) notes that this is particularly important in professional settings where affective goals (e.g. Kraithwohl's taxonomy, 1964) such as attitudes towards professional colleagues or towards specialized choices are often just as important or apparent as are the more traditional cognitive goals (e.g. Bloom's taxonomy, 1956) such as understanding terms, manipulating symbols, doing research, etc. He argues, in fact, that our lack of a more complex and accurate model of classroom environments is a major reason why we have been unable to stem the trend to separate facts and theories from values and emotions that occurs in professional education and that continues in organization and professional life. Fry and Rubin (1972) surveyed graduate students in management and found that, in addition to identifying
learning objectives in three distinct areas (knowledge, skill, and attitude learning), they were also able to identify different environmental factors as having contributed (or not) to their ability to achieve these objectives. Plovnick's (1974) interviews with medical students also suggests that values and attitudes towards career specialties are critical outcomes of professional (medical school) education and that students can identify certain environmental factors as having contributed to their particular attitudes and career choices. Thus in order to understand the learning process in professional settings, one must consider P-E interactions related to outcomes not only in the more traditional cognitive or knowledge centered areas, but also in behavior, or applied skills, and in attitudinal areas having to do with socialized attitudes towards the profession, ethics, values, etc.

Put another way, our models of professional learning environments need to account for the fact that a given educational objective may require a complex set of skills or combination of knowledge, skills, and attitudes. Kuhn (1963), for instance, contends that to do proper scientific inquiry both convergent and divergent qualities are necessary. Although these skills may not have to reside all in one person, the environment set up to teach one how to do scientific research could "fit" with or demand the abilities of the converger and diverger at the same time and in the same setting.

**Thesis Overview**

Given these assumptions and perspectives on "learning environments", Chapter Two will present a new, integrated model of learning environments based on both empirical studies in the literature and various theories
about the design of learning situations. This derivation will also include hypothesized indicators of different types of environmental orientations.

Chapter Three will present an observational tool based on the model derived in the previous chapter and discuss its initial testing and use in a field site. Results from observing ten courses in a department of landscape architecture will be compared to student perceptions of those courses.

Chapter Four will present a theory of learning and a tool for measuring individual learning styles. The test sample will then be "typed" and Chapters Five and Six will discuss the results of looking for hypothesized matches between type of environment and type of learner.

Chapter Seven will offer conclusions and recommendations based on the overall study. A revised model of learning environments will be discussed as will implications for its pragmatic application.
A Model for Diagnosing Learning Environments

A major thesis of this study is that learning environments are neither one way or another but are many things to many people. Thus a necessary ingredient to any study of person-environment interactions is a model for understanding variation in the environment being studied. Such a conceptual framework can then be translated into a measurement technology which, along with a tool for determining individual differences, would enable one to test for interactions or "matches" between treatments or characteristics. This chapter will focus on the development of a conceptual model for viewing variations in learning situations in ways that are commensurate with how learners might relate to them.

A "learning situation" is generally taken to be any situation, formal or informal, where the actor(s) or participant(s) (e.g. students, teachers, trainers, new recruits, etc.) are there, at least in part, to consciously acquire (or help others to acquire) new knowledge, new skills, or new attitudes. For the purposes of this study, a more specific definition of learning environments that foster these situations will be developed below.

Defining a Learning Environment

Finding the appropriate level of type of variation to consider in differentiating learning environments is a monumental effort. Hunt (1971) posed the dilemmas to be expected in this way:

Environmental units vary in size from those as broad as an entire culture to those as minute as a pinpoint of light. Educational environments also vary over a dimension of size, ranging through educational institution, program approach,
curriculum, mode of presentation, and specific lecture statement. Similarly, environments may take account of a variety of time spans. Thus one may analogically consider the psychological climate over a long period of time, or the psychological weather at a specific point in time. (Page 8)

The specific definition of a learning environment, its boundaries, context, actors, etc. seems to be critical in understanding P-E interactions. In his review of research on instructional methods, Milton (1972) concludes that the classroom or a given course is not the appropriate unit of analysis in order to understand college level learning environments. This was based on his overwhelming evidence that there were no qualitative differences among "traditional" classroom measures of pedagogy (e.g. lecture versus discussion designs). Hall's findings (1970) in a study of the effects of teacher-student congruence upon learning in 22 undergraduate classes at Yale suggest a different conclusion. He found "the course" to be a useful delineation of the environment in situations where one expected variances between courses to be roughly equivalent to variances amongst student perceptions. Hall argues that if one factor (P or E) varies out of proportion with the other, we should not expect P-E "fits" or analyses of congruence to explain any more than analysis of that single factor with the high variance. Thus Anderson's ability to only partly relate classroom climate differences to learning, to any significant degree (discussed in Chapter I), does not suggest that the classroom was an inappropriate unit of analysis, but rather that individual differences (related to learning) might well have been considered in addition to his group variables.

Applying Hall's analysis to professional learning environments, one might expect the variance between courses to be most significant with
respect to subject differences (e.g. in a management school: finance, marketing, psychology, etc.) and thus examine P-E "fits" between types of learners and course subject matter or departments. Or one might expect the overt professional or cultural norms to be the significant level of E analysis and look for P-E fits across professions (i.e. law school climate versus medical school climate). Finally, one could consider instructor, curriculum, etc. differences to be the significant level of E analysis and thus investigate P-E fits within a given course or classroom. In support of this latter (classroom/course) definition of environmental boundaries is the lack of any findings in college climate studies, subject-matter comparisons, etc. to add to our understanding of how one learns in day to day situations. In fact, in one of the only studies of climates in professional schools, Bowen and Kilman (1975) do support this definition. They administered their Learning Climate Questionnaire to three graduate business schools. They found that differences in presentation of material and task relationships (in courses) accounted for disproportionate variance in overall satisfaction within the school samples.

For the purposes of this study, the "course" would thus appear to be an appropriate unit of analysis. A learning environment, or course, would then include a series of classroom events or sessions, homework or project assignments, examinations, reports, individual work, group work, library time, etc. In addition, what is assumed to be the environment are those things within the boundaries of a course, like the above, which are determined, designed, set up, or planned to some extent before the fact.*

*As has been discussed earlier, the social interaction or group dynamics of the classroom, _per se_, has been ruled out of this definition of
Variations in Learning Environments

Given the "course" as the unit of environmental analysis, how can one conceptualize situational differences in ways that would relate to individual differences in learning styles? The literature offers two general sets of characteristics which appear useful: the environment's intended "responsiveness" to the individual, and the phenomenological characteristics or "inherent traits" in the environment.

A. Responsive Characteristics:

The degree of responsiveness in the environment is discussed by Moore and Anderson (1968) in terms of the ways in which a setting is intended to enable the learner to relate to it. They identify four aspects or "principles" in the design of learning environments.

(1) Perspectives aspect - the extent to which the environment both permits and facilitates the taking of multiple perspectives toward whatever is to be learned. A "perspective" would be like a role or part in a play and could range from being very active and causal (agent) to being passive with no control (patient) to being judgmental (referee) to being enactive as in interacting with some significant other(s).

(2) Autotelic aspect - the extent to which the activities carried on within the environment are designed to be enjoyed or seen as meaningful and useful in their own right. In such instances there is little or moderate risk to the learner, a clear right to fail, less feelings of competition, and a general belief on the part of the learner that the time being spent is his, under his control, to do with as he pleases. The term learning environments. The relationship of these kinds of factors to our model of environments will be discussed later in this chapter.
paper in many courses is an example of a more autotelic situation than, say, a final examination. Although not entirely free to fail, the learner can have more control over his goals, topic, and time management, and feel less competitive than in taking a one-time exam which is often graded on a competitive basis.

(3) Productive aspect – the extent to which the environment has properties which permit the learner either to deduce things about a topic or object, given a partial presentation of it beforehand, or to make probable inferences about it, again given only partial exposure. Of two ways to learn something, the "productive" one is that which forces the learner to reason for himself and also frees him from depending upon authority. In learning geometry, for instance, deriving or proving theorems from basic axioms would be a "productive" approach versus applying theorems to solve a textbook problem.

(4) Personalization aspect – the extent to which the environment is designed to respond to the learner's activities directly with feedback or permits and facilitates the learner's taking a more introspective view of himself in order to evaluate his own learning. In the first instance, called responsive, the environment allows the learner to discover the problem, gives immediate feedback as to consequences of learner's actions, enables learner to self-pace himself, and generally motivates the learner to test his capacities rather than giving an answer to him which could end his search or thought processes for that activity. The second instance, called reflexive, enables the learner to see himself as a social object. That is, in addition to learning what is to be learned, the environment permits and facilitates the learner to learn
about himself as a learner.

A somewhat polar relationship between the Productive and Personalized aspects of environments is suggested by Harvey, Hunt, and Schroeder (1961) who also deal with the responsiveness of an environment. To them this is the degree to which a learner can enact with, or modify, his environment. They conceptualize a unilateral versus interdependent continuum. In a unilateral situation, the learner must look externally for criteria to fit an absolutistic schemata. This is much like the productive aspect, above, which would be exemplified by a scientist having to rely upon absolute rules of inference in order to explain events in a laboratory. The interdependent situation, on the other hand, is one where the learner learns to view his own behavior as causal in concept formation and information processing. This is similar to the personalization dimension above. In such a situation one would expect to find the learner actively engaged in an activity where the outcome is more dependent upon his behavior (e.g. a group decision-making exercise or simulation) than upon participation in or completion of an externally imposed sequence of events.

In general, the responsive aspects described above could be designed into or planned for, to varying degrees, in any learning environment. Rather than implying that the effective environment is the most perspective, most autotelic, etc., these aspects are intended to be means by which various learning environments might be differentiated. They also represent a more meaningful way to deal with the aspects of learning environments heretofore assumed to be grounded in group dynamics or social interaction in the classroom.

Several investigators have tried to relate group climate variables to
learning outcomes (e.g. Abercrombie, 1971; Anderson, 1973; Cooper, 1976) with varying success. While it is obvious that the classroom can be viewed as a social system consisting of multiple kinds of groups (Thelen, 1967) the relevant question here is whether or not this, like "structure," overgeneralizes comparisons between learning situations. Anderson's (1973) inability to relate his classroom climate indices very well to learning outcomes suggests that his group-oriented factors may not be the most meaningful to differentiate person-environment interactions going on in a course. Abercrombie's (1971) work with the use of groups in teaching offers a useful distinction between categorizing environments in terms of group dynamics (e.g. cohesion, participation, support, etc.) versus categorizing environments based upon individual characteristics or needs observed in effective group functioning. Although she compares group teaching with lecture and tutorial methods, she also argues for general characteristics that all learning environments should include, such as teaching learners to learn (like the Personalization aspect above), overcoming learner dependence upon an older person as source of knowledge (like the Interdependent dimension), etc. Whether or not all learners would prefer these things in all situations is an open question, but it is clear from these examples that the individual needs Abercrombie detects in looking at the benefits of group treatments in learning environments do have relevance to the model being developed here. Thus, instead of classifying learning environments in terms of factors that make groups more effective, the model being developed here attempts to utilize Abercrombie's and others' insights regarding what it is that is going on with individuals when learning -- by group methods or otherwise -- occurs:
Is the experience designed to be personalizing to them; will they be in control of their own learning (autotelic); will they be asked to take different perspectives; will they be expected to exercise their cognitive skills in the most "productive" manner, etc.?

B. Demand Characteristics:

Learning environments can also be viewed as having certain "inherent traits" or demand characteristics which are totally independent of what a learner does, or should do, in the environment. These characteristics typically reflect the nature of the disciplines, source of knowledge, or professional norms of the field of study. As such, they can be assumed to influence textbooks, literature, cases, problems, and methods of teaching used in courses.

Biglan's (1971) multidimensional factor analysis of professors' ratings of similarities and differences between academic subject matter in a large university derived two bipolar dimensions that typify subject areas and conceivably differentiate courses within general subject areas as well. These dimensions are shown in Figure 1 and discussed below.

1. Applied versus Pure dimension - The Applied dimension typified engineering and business studies where there is often more than one correct interpretation of an event or data (e.g. the answer is subject to criteria of acceptability, feasibility, sellability, people's tastes, feelings, etc.). The Pure end of this dimension typified languages and some sciences where the interpretation of events or data is almost entirely determined by objective, rational, proven rules and theories or by accepted constructs.
Figure 1. Similarities among 36 Academic specialties at University of Illinois (after Biglan, 1973).

SOFT

- Secondary Educ.
- Special Educ.
- Educ. Admin.
- Communications
- Finance
- Accounting

APPLIED: \[ -9 \quad -8 \quad -7 \quad -6 \quad -5 \quad -4 \quad -3 \quad -2 \quad -1 \]

HARD

- History
  - English
  - German
  - Political Science
  - Russian
  - Philosophy
  - Sociology

- Psychology
  - Anthropology

- Computer Science
- Dairy Science
- Horticulture
- Civil. Engr.
- Agronomy
- Mech.
- Nuclear Engr.
- Astronomy
  - Chemistry
  - Physics

- Math
- Physiology
- Etymology
- Zoology
- Botany
- Microbiology
- Geology
(2) Paradigm versus No-paradigm dimension - This separates the basic sciences from the humanities. Kuhn's (1970) description of prerequisites for a "normal science" would typify a paradigmatic situation wherein problems serve as tests of the learner's cognitive skills, where the solution is often less intrinsically rewarding than having attacked the "puzzle," where there is a dependence on symbols or interpretative rules of inference that make up the field of study, and where there is low tolerance for ambiguity (e.g. the criteria for a good paradigmatic problem is the assured existence of a solution). At the no-paradigm end of this dimension, we would find the opposite kinds of situations, where there was an accepted degree of uncertainty, no assurance of a single, right answer, and where the outcome of the problem or task undertaken is intrinsically meaningful to the learner, regardless of the process he had to go through to get it. This kind of situation would parallel Moore and Anderson's Personalization aspect, while the paradigmatic environment would be a Productive situation in their terms.

(3) Theory versus Practical dimensions - Pace (1960) studied institutional similarity by factor analyzing student perceptions of environmental-press variables in 32 colleges. The bipolar dimension accounting for most of the variance consisted of two factors: theoretical-intellectual versus practical-status-oriented. The Theoretical-Intellectual situation appears to be a mix of Biglan's Pure and Paradigmatic environments, while the Practical-Status-oriented situation is more like Biglan's Applied-Non-paradigm situations where individuals are actively engaged in activities that lead to outcomes they value. Pace further found that his theoretical-practical dimension could be separated into two parts, one
emphasizing humanistic, reflective, and sentient pressures, and the other emphasizing pressures towards scientific rigor, competition, and autonomy. The first of these parts is interestingly similar to Moore and Anderson's Personalization aspect, particularly the reflexive condition where the learner is encouraged to utilize his senses to reflect upon himself in the context of what he is doing.

Kolb's (1977) analysis of Carnegie Commission on Higher Education data from a much more extensive sample than Biglan's suggests environmental demand characteristics similar to those above. Using tabulations of 32,963 graduate student responses in 158 institutions and of 60,028 faculty responses in 303 institutions, he created ad hoc indices to measure 45 academic fields along two hypothesized dimensions. An abstract-concrete index was based on student response to questions concerning the importance of undergraduate backgrounds in mathematics and humanities for their current field of study. An active-reflective index was created from faculty data regarding the percent of faculty in a given field who were engaged in paid consultation to business, government, etc. (i.e. an indicator of the active, applied nature of the field). Groupings of academic fields based on these indices are reproduced in Figure 2. Kolb's results are highly consistent with Biglan's. In addition to reinforcing the widely shared scientific versus artistic distinction (Snow, 1963; Hudson, 1966) these results suggest an additional dimension of action-reflection, similar to Pace's applied-theoretical distinction.

Although these demand characteristics of environments emanate from comparisons between fields (or academic departments representing a field), they are taken to be relevant areas for distinguishing amongst courses
Figure 2. Concrete/Abstract and Active/Reflective Orientations of Academic Fields From the Carnegie Commission Study of American Colleges and Universities (Kolb, 1977).

CONCRETE
(Humanities important)

10
French •
Spanish •
German •

20
Art •
English •
Library Science •

30
Social Work •
Speech •
Philosophy •

ACTIVE

Architecture •
Edu. Admin. •
Psych. •
Psychology •

Education •
(Faculty consults)

90
80
70
60

50
40
30
20
10

Reflective
(No consulting)

50
40
30
20
10

REFLECTIVE
(No consulting)

60

Geography •
Zoology •

Business •

Physiology •
Botany •
Agriculture •
Economics •

Bacteriology •

Ecology •

80

Biochemistry •

Chem. Engr. •

90

Physic •

Mech. Engr. •

Elect. Engr. •

Math •

Chemistry •

ABSTRACT
(Mathematics important)
within a field or department as well. It has already been suggested (Chapter I) that in professional education the multiplicity of goals and desired learning outcomes requires that environments teach different, and often dialectically opposite, styles, attitudes, or methods. Kuhn's (1962) thesis that scientific research demands both convergent and divergent abilities speaks to this issue. Medicine, as well, requires both a concern for human service and scientific knowledge. Architecture has requirements for artistic and engineering excellence (Abercrombie, 1966). Management is yet another example where skill at both quantitative and qualitative analysis are required. Thus it is reasonable to expect that within a given school or department courses will vary in the extent to which they are designed to teach one or several of these abilities. In a management school curriculum, for instance, one finds courses in basic statistics or economic theory (pure, hard, abstract, theoretical, etc.) with courses in case analysis of business policy or labor relations problems (applied, soft, concrete, etc.). In reality, each of these courses is probably designed to teach a mixture of things along these demand dimensions and as such can be usefully compared along these dimensions.

**Relationship Between Responsive and Demand Characteristics**

A model of learning environments begins to emerge when the responsive characteristics along which they can vary are related to the demand characteristics just discussed. In Figure 3 the bipolar dimensions from Biglan and Kolb have been used (capital letters) to represent a base or field-space upon which the different responsive aspects of environments
Figure 3. Relationship Between Environmental Demand and Response Characteristics.

No-Paradigm

HUMANITIES-BASED

Personalized-Responsive

Interdependent

Practical Status-oriented

PRACTICAL

Applied Autotelic

CONSULTING

Scientific Autonomous

Productive

THEORY

Pure Perspective

NO-CONSULTING

Theoretical Intellectual

MATH-BASED HARD

Paradigmatic

KEY - Demand Characteristics - capital letters
Response Characteristics - lower case
(lower case letters) are placed. These connections or hypothesized relationships are based upon the definitions and descriptions of these constructs in the literature discussed above. From this mapping four distinct domains or areas in which environments can vary are defined. These "domains" are represented in Figure 4. They have been labeled Affective, Perceptual, Symbolic, and Behavioral.

A. The Affective Domain - This aspect or type of environment typifies situations where what is being learned is non-paradigmatic and humanities-based. The emphasis is on the individual learner's understanding his feelings, values, reactions, etc. to subject matter or problem situations. It is highly personalized in giving feedback to the learner vis a vis his actions and in changing activities or events based on what the learner wants to do or desires to change. It tolerates ambiguity more than the other types and tends to be very interdependent.

B. The Symbolic Domain: This aspect of environments is most easily contrasted with the Affective domain. What is being learned tends to be science-based and paradigmatic. Thus there is emphasis on getting solutions and deriving theories using strict rules of logic, symbols, analytical methods, etc. Information is abstract and events control learners (unilateral) in contrast with Affective situations.

C. The Perceptual Domain: This aspect of environments emphasizes the exploration and understanding of basic relationships between causes of events and phenomena. Learners are encouraged to watch, listen, think, and reflect on things from different points of view before determining their own.
Figure 4. A Model of Learning Environments.
D. The Behavioral Domain: Here the emphasis is on use or application rather than understanding or theory. It is autotelic in nature. Learners are more responsible for their actions and what they do influences what they can or will do next. Learners tend to work alone and on practical or real problems as if they were professionals.

**Flexibility in Environmental Domains**

Learning environments can be flexible in terms of the degree to which they emphasize or reflect the characteristics of any domain in the model just developed. In either of the four domains (Affective, Perceptual, Symbolic, or Behavioral) a situation can range from simplistic to being very sophisticated. With respect to the Affective domain, for example, a thirty-minute group discussion of a classroom exercise with specific questions to discuss would be on the simplistic side of the scale, while a T-group discussion would be considered more Affectively sophisticated because it was more open ended, allowed greater ambituity, encouraged more expression of personal feelings, etc.

This notion of flexibility in degree of emphasis on different environmental qualities (domains) is somewhat similar to what Schroder et. al. (1967) refer to as "degree of structure." In their schema, degree of structure reflects the amount of predetermination of certain aspects of a situation like feedback, punishment, or reward. In this model, "flexibility" reflects the fact that environments vary in how affective, how perceptual, how symbolic, and how behavioral they are. With respect to the Perceptual domain, for example, one can be flexible in terms of answering the following questions in designing the environment: how many perspectives can the learner take; how necessary is it to take on more
than one point of view; how much time is allowed for reflection versus other activities; or how basic, fundamental, or original is the subject matter being considered?

Kolb and Fry (1975) have hypothesized the elements or indicators of sophistication in each of the four domains of learning environments.

(1) A sophisticated Affective environment emphasizes:
   a. focus on here-and-now experiences
   b. legitimization of expression of feelings and emotions
   c. situations structured to allow ambiguity
   d. high degree of personalization

(2) A sophisticated Perceptual environment emphasizes:
   a. opportunities to view subject matter from different perspectives
   b. time to reflect and role (e.g. listener, observer) which allows reflection
   c. multiplicity of observational frameworks

(3) A sophisticated Symbolic environment emphasizes:
   a. emphases on recall of concepts
   b. thinking or acting governed by rules of logic and inference
   c. situations structured to maximize certainty
   d. authorities respected as caretakers of knowledge

(4) A sophisticated Behavioral environment emphasizes:
   a. responsibility for setting own learning goals
   b. opportunities for reality testing
c. environmental responses contingent upon self-initiated action

d. opportunities to manage one's time

Before determining behavioral measures of these indicators, it is important to note one further implication of the model being developed. In addition to varying in the degree to which a particular domain is emphasized, learning environments also differ in the degree to which they emphasize combination of domains.

**Complexity in Learning Environments**

Based upon the discussion above, a learning environment is being conceptualized here as four-dimensional space. Learning environments are thus complex in that they can be characterized by, or emphasize, more than one domain at any particular time. An environment (course) could, for example, be complex in that it could be both personalized and paradigmatic at the same time, even though these dimensions are considered opposites to each other. A lecture can be unilateral, theoretical, and paradigmatic to one listener who is trying to understand a concept while, at the same time, be personalized, reflective, and non-paradigmatic to the listener who is viewing the lecturer as a model of the profession, expert in the field, or just as someone the listener would like to emulate. It is likely that the individual learner will experience a dialectic tension between being personally involved in an experience or analytically detached and thus make some choice based on his needs and abilities, but the environment can nonetheless fulfill both needs at once, if necessary, to accommodate several learners. This notion of complexity seems particularly
appropriate for understanding person-environment interactions in professional learning situations where it is likely that serveral learning objectives are being serviced at any single point in time: learning a theory; solving practical problems; developing new insights; internalizing professional standards of practice; etc.

So far, this discussion has conceptualized a model of learning environments consisting of environmental response and demand characteristics. The model proposes four distinct areas or domains with which to characterize learning environments. The model also implies that, within each domain, the environment can vary from being simplistic to sophisticated and that environments vary in terms of how many domains they typify at any point in time. We now turn to a discussion of specific environmental measures, based on this model, in order to test its validity.

**Measures of Learning Environments**

In order to ultimately be able to measure person-environment interactions, the model depicted by Figure 4 must be translated into indicators that either an observer or a learner could perceive and measure. Joyce and Weil (1972) identified and analyzed sixteen different models of classroom teaching with respect to behavioral differences. The comparative categories that emerged offer categories for selection of specific measures. These categories of variables were:

(1) **Orientation** or focus of the model: this involves a description of the aspects of the student and the environment which are most emphasized or the primary goal of the proposed learner-environment interaction.

(2) **Syntax:** has to do with a description of the model in action,
those things that describe or typify the major activities in a particular model.

(3) **Principles of Reaction**: have to do with those principles that may guide the teacher or another agent (nonstudents in the traditional sense) in their relation to student activity. This would include what and how feedback is given, upon what bases learners are motivated and rewarded, etc.

(4) **Social System Characteristics**: have to do with the kinds of student-teacher roles, a description of hierarchial relationships and what kinds of student norms exist in the learning environment.*

(5) **Support Systems**: have to do with necessary requirements needed to bring a particular activity off. These can come from two sources, role specifications for the teacher and demands of the substantive nature of the activities, i.e. expert and documental information.

These constructs were taken as guides to form descriptive scenarios of idealized conceptions of each of the four kinds of environments in our model. Specific indicators were hypothesized for each of the types of environments in each of the above five categories. These are summarized in Table I.

A. **Objectives**: These are indicators of the major intended purpose or goal of an activity or cluster of activities in a course. In Affective and

*It is interesting to note Joyce and Weil's use of "structure" in this context. They suggest that the degree of structure in a learning environment is the extent to which these social characteristics, roles, relationships and norms are prescribed or externally imposed versus emergent or more subject to learner needs and control. Perhaps this notion of structure can be applied to all the dimensions or variables in a model of the environment. The degree to which any and all of them are prescribed externally versus emergent from learner demands at a particular moment (student pull) would be viewed as a correspondingly highly or lowly structured situation.
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<th>CATEGORY OF INDICATOR</th>
<th>TYPE OF ENVIRONMENT</th>
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<td>Affective</td>
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<td>1. Objectives:</td>
<td>Basic purpose is to experience an event or activity, to be aware of one's feelings while going through it.</td>
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<td>2. Principal focus or source of information being dealt with:</td>
<td>Information is here and now, in the form of personal feelings, values, opinions, ideas, etc.</td>
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<td>3. Nature of feedback and rewards:</td>
<td>Feedback is personalized, based on each individual's own needs and learning goals.</td>
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<td>4. Nature of learner's role:</td>
<td>Learners freely express personal feelings, opinions, and values concerning topic or activity they are engaged in.</td>
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<td>5. Teacher Role:</td>
<td>Teacher portrays a model of the profession and colleague such that learners learn by his example and through relating (identifying) with him.</td>
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<td>Symbolic</td>
<td>Behavioral</td>
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<tr>
<td>Basic purpose is to solve a problem, to obtain a solution through use of theory and analytical skills.</td>
<td>Basic purpose is to apply skills and knowledge to practical problems such as one would experience as a professional.</td>
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<td>The source of information is abstract or there and then, derived from readings, lecture inputs, compiled data, etc.</td>
<td>Focus of information flow is on getting some task done, derived from previous work, plans, critiques, evaluations of progress, preparing for a presentation, etc.</td>
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<td>Performance is evaluated against right or best answer as judged by the body of knowledge or the teacher's expert opinion.</td>
<td>Output is evaluated against criteria of practicality, feasibility, sellability, etc.</td>
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<td>Activities and communications are governed by rules of inference, methods, terms, etc. often subject to learners' memory recall.</td>
<td>Learners make own decisions about use of their time. Choice and actions at one point in time influence what occurs next.</td>
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<td>Teacher is the expert authority, interpreting the field of knowledge or judging what is correct, competent, acceptable performance. He may also be an enforcer of rigor, methods, or rules stipulated by the body of knowledge he represents.</td>
<td>Teach is a consultant or coach available at the learner's request to advise or impart his knowledge of the field he represents.</td>
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Perceptual environments, the goals are internally oriented: to personally experience something on the one hand, and to personally understand how or why things take place on the other. More object-focused goals are typical of Symbolic environments where one strives to get an answer or solve a problem via analytical methods, and of Behavioral environments where the goal is to apply knowledge and skills to a real or practical problem.

B. Principal Focus or Source of Information: This category distinguishes the different use and/or source of data the learner is expected to handle or work with. The basic source or origin of information differs between Affective and Symbolic environments. In the former information is created or based on learner feelings, emotions, reactions in the present, while in the latter case information comes from the past or abstract as in readings, reports, data, etc. The focus or use of information differs between the other two domains. In Perceptual environments the focus and reason for using information is derived from examining how something occurs or why things are related, as opposed to Behavioral environments where information is retrieved from previous work, plans, results, and used to get some task done.

C. Nature of Feedback and Rewards: Feedback is highly personalized and minimally comparative in Affective environments. In Perceptual environments the feedback can be personalized or not depending on what the learner determines to be the criteria and standards for evaluation. In Symbolic situations performance is judged by experts and/or the existence of right answers, leaving little room for interpretation by the learner. In Behavioral situations outputs are measured against criteria of practicality, feasibility, etc., usually determined by others.
D. Nature of Learner's Role: This category differentiates the various rules of behavior or norms (implicit or explicit) that learning environments are intended to promote, regardless of the social interactions that eventually take place in them. Affective environments are those that intend and foster free expression of learner feelings, emotions, and values at any time. Perceptual environments encourage learners not to act, but rather to think, listen, reflect, watch, etc. in order to determine meaning and relevance of something. In Symbolic situations actions are more governed by rules of inference, analytic methods, symbols, etc. chiefly determined by the subject matter and often subject to the learners' ability to recall. Learners are more architects of their own roles in Behavioral settings so long as they take initiative to decide how to use time, and make choices concerning sequence of activities or tasks to do.

E. Nature of Teacher's Role: In learning environments where teachers are present, their behavior is probably one of the major determinants of dominant characteristics of that situation. Although there have been numerous attempts to classify or label teacher and leader "types" (e.g. Adelson, 1961; Ryans, 1960; Blake and Mouton, 1968) it is clear that, as we argued for the concept of "environment," teacher roles are also complex. Seldom is one just a priest or just a magician (after Adelson's typology). Schein and Hall's (1967) analysis of graduate student, professional manager, and faculty perceptions of the "good" and "bad" teacher offer more meaningful dimensions upon which to typify teacher roles. They identified three factors that were common to all their studies. The first is Competence (Type C), which typified the clever, intellectual, scientific, clear thinking, knowledgeable, and experienced teacher. This is one who
represents authority or knowledge as an expert, although he may not have any real personal power. He either relies on complex rules or rigorous methods or he manipulates processes he personally understands. Next is the Supportive (Type S) teacher who is sincerely concerned with the student's welfare and is faithful to this end. He is seen as sincere, warm, trusting, helpful, kind, and sensitive. He teaches through helpful insights and a general commitment to help the student to better his own potential. The third factor, Potency, was suggested by Schein and Hall to be possibly two factors in reality. Personal Potency (Type Pp) depicted the teacher who possesses charisma, power, energy, enthusiasm, ambition, etc. and teaches students by example and identification. Role Potency (Type Pr) describes the teacher who is committed and excited about being a teacher. He enjoys representing a profession or authority, although he has little power of his own. Students learn by internalizing the values he represents. The hypothesized relationships between these factors and the environmental model developed above are shown in Figure 5. Teachers dominant in the competency area (Type C) are hypothesized to be most useful in very Symbolic environments and secondarily in Perceptual environments. In activities where the information is abstract and often subject to rules of inference, jargon, and strict methods of handling, teachers who act as experts or authorities to resolve critical student questions would seem to be most appropriate. The opposite is thought to be true of the Affective environment where rather than the expert authority, the useful teacher would seem to be one dominant in personal potency (Type Pp) area. This teacher has the personal qualities to be a role model for students so they can relate to him or her as a person and perhaps as if they were
Figure 5. Hypothesized Relationships Between Schein and Hall's Teacher Types and Types of Learning Environments.

AFFECTIVE ENVIRONMENTS

Type P_p

Type P_p(s)

Type P_r(P_p)

Type S

Type P_r

Type C

Type C(P_r)

Type C

SYMBOLIC ENVIRONMENTS

Key:  C = competent
S = supportive
P_p = personally committed to teacher role and student needs
( ) = secondary or complementary style
professional colleagues; someone to share ideas, feelings, and opinions with. The student's concern in these environments would be "can I be like s/he is in such a situation" rather than "what is his/her solution or advice." Teachers most useful in Behavioral environments are also hypothesized as being dominant in the potency area, but in role (versus personal) potency area (Type Pr). This type of teacher's genuine interest in teaching, showing, demonstrating, etc. so that others can follow by example would seem to fit well with the applied, "try it out," apprenticeship nature of behaviorally-oriented environments. Such a teacher would not need to be always correct or even to have an answer to every question (like Type C) but should rather always show interest in the student's need to pursue a task and thus serve as a supportive friend in that endeavor, if nothing else. Finally, the supportive teacher (Type S) is seen to be most useful in Perceptual environments where his or her concern with bettering the student's potential (in this case to reason, to discover relationships, to ask the right questions, etc.) would probably keep him from giving expert answers too soon or from showing by example and running the risk of students not really internalizing something for themselves. Being concerned with the student's welfare in this type of environment would appear to necessitate a more nondirect, probing, insight-offering approach versus a direct or even personal approach offered by other teacher types.

Hypothesized Scenarios of Learning Environments

Given the behavioral indicators from above, the model of learning environments developed thus far describes four distinct domains or types of learning situations. Keeping in mind that a course could conceivably be a
mixture of several of these types (environmental complexity), the following scenarios are hypothesized as examples of sophisticated environments in each domain.

**Affectively sophisticated** learning environments are ones in which the emphasis is on experiencing what it is actually like to be a professional in the field under study. Learners are engaged in activities that simulate or mirror what they would do as graduates, or they are encouraged to reflect upon an experience to generate these insights and feelings about themselves. The information discussed and generated is more often current/immediate. It often comes from expressions of feelings, values, opinions by the learner in discussions with peers or the teacher. Such expressions of feelings are encouraged and seen as productive inputs to the learning process. The learner's activities often vary from any prior schedule as a result of the learner's needs. The teacher serves as a model for the profession. He relates to learners on a personal basis and more often as a colleague rather than an authority. Feedback is personalized with regards to each individual's needs and goals as opposed to comparative. It can come from both peers and the teacher. There is accepted discussion and critique of how the course is proceeding and, as such, specific events within a single class session are often more emergent than prescribed.

**Perceptually sophisticated** learning environments are ones in which the primary goal is to understand something: to be able to identify relationships between concepts, to be able to define problems for investigation, to be able to collect relevant information, to be able to research a question, etc. To do this, learners are encouraged to view the topic or subject matter from different perspectives (their own experience, expert
opinion, literature) and in different ways (e.g. listen, observe, write, discuss, act out, think, smell). If a task is being done or a problem being solved, the emphasis is more on how it gets done, the process, than on the solution. Success or performance is not measured against rigid criteria. The learner is instead left to conclude, answer, define criteria of success for himself. Individual differences in this process are allowed and used as a basis for further understanding. Learners are thus free to explore others' ideas, opinions, and reactions in order to determine their own perspective. In this process the teacher serves as a "mirror" or "process facilitator." He is nonevaluative, answers questions with questions, suggests versus critiques, and relates current issues to larger ones. He emphasizes a reward system that emphasizes methodology or inquiry versus getting a particular answer. In class sessions there is planned time spent on looking back at previous steps, events, or decisions in order to guide the learner in future activities.

Symbolically sophisticated learning environments are ones wherein the learner is involved in trying to solve a problem for which there is usually a right answer or a best solution. The source of information, topic, or problem being dealt with is abstract in that it is removed from the present and presented via reading, data, pictures, lecture inputs, etc. In handling such information, the learner is both guided and constrained by externally imposed rules of inference, such as symbols and computer technology, theorems or protocols, and terminology. There is often a demand on the learner to recall these rules, concepts, or relationships via memory. The teacher is the accepted representative of the body of knowledge. As such he judges and evaluates learner output, interprets
information that cannot be dealt with by the rules of inference, and en-
forces methodology and the scientific rigor of the field of study. He is
also a timekeeper, taskmaster, and enforcer of schedules or events in or-
der that the learner can become immersed in the analytical exercise
necessary to reach a solution and not worry about having to set goals and
manage his own time. Success is measured against the right or best solu-
tion, expert opinion, or otherwise rigid criteria imposed by the teacher or
accepted in the field of study. Decisions concerning flow and nature of
activities in the class session are essentially made by the teacher only
and mostly prior to the course.

Behaviorally sophisticated learning environments are those in which
the emphasis is upon actively applying knowledge or skills to a practical
problem. The problem need not have a right or best answer, but it does
have to be something the learner can relate to, value, and feel some in-
trinsic satisfaction from having solved. This would normally be a "real
life" problem, case, simulation that the learner could expect to face as
a professional. In attacking the problem, the focus is on doing. Com-
pleting the task is essential. While there may be an externally imposed
deadline or periodic checkpoints for which reports or other information are
required, most of the learner's time is his to manage. He is thus con-
cerned with what effect his present behavior will have vis a vis the over-
all task to be done. The next activity he engages in will not occur inde-
dendent of the one he is presently in. In this way the learner is always
left to make decisions/choices about what to do next or how to proceed.
The teacher can be available as a coach or advisor, but primarily at the
learner's request or initiative. Success is measured against criteria
associated with the task: how well something worked, feasibility, sellability, client acceptance, cost, testing results, aesthetic quality, etc. Performance is also measured by results, regardless of methods. Even if a learner may never attend formal class sessions or may choose to work on his own time, he is evaluated by his output.

Summary

Using concepts of environmental responsiveness and empirically based notions of demand characteristics of field and subject matter, a model of learning environments has been posited. This model distinguished four basic types of domains of an environment: affective, perceptual, symbolic, and behavioral. In addition, the model conceives of a learning environment, defined as a course for this study, to be a mixture of these types and therefore complex. It can also be more or less sophisticated in the degree to which it is designed to typify any of these types. Finally, specific indicators for each type of environment have been hypothesized in five categories: objectives of major activities, principal focus or source of information, nature of feedback and rewards, rules or norms influencing student roles, and nature of teacher roles.

The first step in validating the model and constructs offered here will be to design a measurement tool, based on the model, and to try to measure environmental differences with it. This is the focus of the next chapter.
Measuring Learning Environments

This chapter is concerned with the design and initial testing of an observational instrument to measure differences in environmental flexibility and complexity amongst various courses in a field test site. This is a prelude to actually testing for person-environment interactions in a professional learning environment.

The field test site chosen was a department of landscape architecture within a larger graduate school of design. Besides meeting the criteria of being a training ground for professionals; this site also appeared to be one in which differences in learning environments similar to those posited by the model in Figure 4 (page 51) could be assumed to exist, a priori. Given Mackinnon's (1962) personality study of successful architects whom he characterized as having the "juggler-like ability to combine, reconcile, and exercise the diverse skills of businessman, lawyer, artist, engineer, and advertising man," it seems reasonable to expect that the curriculum in a department such as this would include courses that varied in the teaching and application of these skills. A course could, for example, be behaviorally and symbolically oriented, towards the engineer's convergent skills, or affectively and perceptually oriented, towards the artist's divergent skills, or both. Such a setting was necessary in order to test the face validity of the constructs in our environmental model.

Design of an Observational Instrument

An observational instrument as a mechanism for measuring learning
environments was chosen in the hope that, if shown to be valid and reliable, it (or a revised version) could ultimately serve as a self-administerable instrument for teachers and/or learners to diagnose their learning environments quickly, either prior to or during the actual course, in order to assess the need for change or mid-course corrections.

The basic design issue in creating such an instrument is the determination of the level of inference desired in order for the rater to rate a particular variable or item on a scale. Walberg, et. al. (1972) note the differences between asking an observer to rate the "ecology" of the setting, the explicit, observable and controllable attributes in learning situations, versus the "ambience" or selective perception of the quality of these very same ecological factors. Rosenshine (1970) defines the choice in terms of "low and high inference" measures. A low inference measure is a specific, denotable object or behavior (e.g. teacher talk in form of question) that is most often counted by the observer so that frequency of occurrence is the unit of analysis. On the other extreme is the high inference measure where the rater must infer the existence, frequency, and value of a construct (e.g. clarity, student-centeredness) and then evaluate it as being, for example, superior versus unacceptable on some scale.

The advantages to low inference measures are obvious in terms of inter-rater and intra-rater reliability. Also, it is likely that relatively little expertise or training is necessary to prepare one to rate (or count) such indicators. The disadvantages to these types of measures is that they are difficult to relate to learning outcomes, probably because they do not reflect the world as the learner experiences it.
For example, while the amount of teacher talk versus student talk is easy to tabulate and time, there is little evidence to suggest that this measure will make a difference in whether or not a particular learner learns a particular subject. High inference measures, on the other hand, may ultimately provide more meaningful interpretations in terms of person-environment interactions, but they are subject to problems of low inter- and intra-rater reliability because they require judgements on dimensions of quality, usefulness, relevance, etc.

Rosenshine (1970) reviewed seven investigations where teacher behavior was observed using high (HI) and low (LI) inference measures. In all these studies, some HI and LI items were significantly related to an adjusted criterion score or they significantly differentiated teachers who were grouped according to student achievement. In all but one of the studies, however, the bivariate correlations or F. ratios presented were greater for the rated measures (HI) than for the counted measures (LI). (The raters were either students or observers and the inter-rater reliability of both types of measures was compatible).

Since one of the anticipated outcomes of this study is the validation of new constructs for relating learning environments to learner styles, it was necessary to create high inference indicators since it was not the position of the author that low inference items were, in fact, meaningfully related to learner behavior. It was hoped that by emphasizing behavioral indicators of a construct, satisfactory inter-rater reliability could be achieved and thus eventual analyses of environmental ratings and learning styles would serve as a test of the environmental model discussed previously.
Methodology

A twenty item observer rating form was designed based on the hypothesized model of learning environments developed in Chapter II. Each of five pages was devoted to one of the categories of environmental variables: objectives (four items), nature of information (four items), potential for feedback (four items), rules of behavior (four items), and teacher roles (four items). With this preliminary observer form in hand, the author sat in on two selected courses in the Department of Landscape Architecture (DLA) to look for further behavioral indicators of the various items that appear to be specific to this test site (e.g. the distinction between classroom lectures or discussion and "studio" time where students work at their benches). Certain jargon terms like "studio," "desk crits," etc. were added to the form where appropriate. An extra item was also added to the "teacher role" category, describing the teacher as a taskmaster, time keeper, or enforcer of schedules. This seemed to be a characteristic that differentiated the teachers involved in the two courses being observed. This item was hypothesized to be related to both symbolically and behaviorally complex environments. The resulting twenty-one item observer form, labeled the Learning Environment Diagnostic (LED), is shown below.
LEARNING ENVIRONMENT DIAGNOSTIC

A. Purpose/Objective of activities:

These questions relate to the activities that describe and distinguish this course "in action": things that tell about the shape of events learners engage in which most typify this course setting. Based on observations and assessment of how "typical" they were, determine what the "major" aspects of the session are and answer the following:

1. To what degree is the emphasis to achieve understanding on the part of the learner (e.g. discussion of concept; collection of information; finding/defining problems; researching a topic in the library)?

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2. To what degree are learners involved in solving a problem (e.g. there is a specific solution/result to be attained -- a right answer exists)?

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3. To what degree do learners focus on experiencing what they are doing (e.g. what it is like to be in the role of a L.A.: express feelings, ideas about activities they are engaged in)?

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4. To what degree are learners actively engaged in applying knowledge and skills on a practical, everyday problem (e.g. doing a site plan or design; presentation to a client; master planning at bench; long term planning for development of site)?

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B. Principal focus or source of information being dealt with:

5. To what degree is the source of information "here and now" or having to do with what is going on at the moment (e.g. creating or designing at learner's bench; class evaluating student presentation; visiting a site; expressing individual feelings, values, ideas; team setting goals for design project)?

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6. To what degree is the source of information abstract or "there and then" (e.g. discussing methods, concepts; looking at pictures, graphs of a site; reading or listening about something done in the past)?

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7. To what degree is the focus on the process or how something gets done (e.g. generating, discussing criteria; hypothesizing about...; reviewing progress, procedure to date; concern for approach to a problem)?

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8. To what degree is the focus on doing some task (e.g. finishing a site work-up; getting data to the computer; coming up with a master plan of...; preparing for a presentation about...; getting a paper written for...)?

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C. Intended Learner Behavior/Roles:

This dimension is concerned with the extent to which "rules" govern learner activities or behaviors and where these rules come from. Answer the following with respect to what represents the primary or major activity(ies) that constitute the course (e.g. studio time at benches; "class sessions" in breakaway room; lectures; presentations; reviews; papers).

9. To what degree are activities and communications constrained/governed by rules of inference, jargon, methods, symbols (e.g. is it necessary for learners to memorize terms, labels, codes, data for recall; use complex graphical keys; have high level graphical skill; adhere to guidelines, schedules, etc.)?

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10. To what degree are learners encouraged not to act, but to observe, reflect, listen, etc. in order to determine meaning/relevance of subject matter for himself (e.g. learner is put in position to explore others' ideas, watch, listen, discuss implications, read, or write in order to select his own perspective; learner left to conclude for himself; peer differences are discussed and seen as source of learning)?

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11. To what degree does the learner make decisions/choices about what he does based on implied consequences with respect to a task (e.g. what he does now will determine -- to a large degree -- what he will have to do next; learner left to take own initiative to get something done; learners come and go as they please)?

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12. To what degree do learners express personal opinions about or reactions to course activities or to a topic (e.g. expression of attitudes, values, aesthetic concerns; evaluation of others; evaluation of content or process -- "I think, I feel that, I want to...")?

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D. Intended Teacher Roles:

13. How often is the teacher nondirective/intuitive (e.g. teach via insight or understanding; answers questions with questions; is non-evaluative; suggests versus critiques; seen as a guru, visionary, creative, etc.)?

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14. How often is the teacher a "consultant" or "coach" -- available to help learners at their request (e.g. called upon because he/she represents professional values, experiences, perspectives, etc.)?

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15. How often is the teacher an "organizer" or a "taskmaster" (e.g. timekeeper; creates and enforces rules/schedules; starts and/or ends classes; terminates one activity and starts another in same session; seen as impersonal, efficient, knowledgable, a methodologist)?

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16. How often does the teacher portray (or behave like) a leader-by-example such that learners are expected to learn more from what/how he does (identification) than just what he says (e.g. models behavior; acts as if he were a professional on that problem; is a "colleague" to the learner; is committed to developing each learner's potential; is seen as personable, charismatic, a model, etc.)?

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17. How often is the teacher the "final authority" (e.g. gives the answer; ends discussions with summary; determines the right answer; interprets a field of knowledge or perspective for the learner; seen as clever, competent, etc.)?

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E. Potential for Evaluation/Feedback:

This set of questions has to do with type of feedback and/or evalua-
tion the learner gets on a session-to-session basis: not just at the end
of the total course.

18. To what degree is there personalized, evaluative feedback based
on the individual learner's needs, goals, and/or abilities, from either
teacher or peers (e.g. bench reviews, critiques; individual-faculty
assessments, class evaluations of presentations, team review of member's
performance; oral exam with teacher; setting individual goals on a pro-
ject; etc.)?

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19. To what degree is there an emphasis on the learner determining
criteria versus evaluating or being evaluated (e.g. peer discussions of
what criteria for solution or decision should be; learner ultimately left
to determine own standards/criteria for evaluation; learner evaluated
based on ability to determine acceptable criteria, perspective, or ap-
proach)?

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20. To what degree is performance or decisions by learner evalu-
ated against "right answer," one person's opinion or other explicit cri-
teria (e.g. graded papers, projects; computer simulations; objective
exams; theoretical deduction)?

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21. To what degree is learner performance/decision evaluated or
tested against criteria of relevancy or practicality (e.g. "how would it
work;" "is it feasible;" "how does it stack up with what ____ did;" "could
it be done;" "would it sell;" more than one way to do it; etc.)?

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Scoring the LED

Four raw scores, each reflecting a degree of orientation related to our environmental model in Chapter II are arrived at in the following manner:

A. The Affective Orientation is the sum of the scale scores on the following LED items:

(3) Major purpose is to experience a professional situation;
(5) Information is here and now, focusing on personal ideas, feelings, opinions, etc.;
(12) Learner encouraged to share feelings, values, etc.;
(16) Teacher is leader-by-example, role model, etc.;
(18) Feedback is personalized, based on individual goals, etc.

B. The Perceptual Orientation is the sum of scale scores on the following items:

(1) Major purpose is to understand a concept;
(7) Information is centered on how and why events or phenomena relate;
(10) Learner encouraged to take on multiple perspectives;
(13) Teacher is nondirective, intuitive;
(19) Learner determines own criteria of relevance.

C. The Symbolic Orientation is the sum of scale scores on the following items:

(2) To solve a problem;
(6) Nature of information is abstract, etc.;
(9) Dialogue governed by rules of inference, jargon, symbols, etc.;
(15) Teacher is taskmaster;

(17) Teacher is expert, interprets body of knowledge;

(20) Learner is judged right or wrong, good or poor, etc. (Since there are two "teacher role" scales attributed to this type of orientation, the sum of these six scales is normalized to be equivalent to the other types which are based on five scales.)

D. The Behavioral Orientation is the sum of the scale scores on these remaining LED items:

(4) To apply knowledge, skills to a relevant problem;

(8) Information dealt with is focused on doing a task;

(9) Learner governs own time and activities;

(14) Teacher is coach, helper at learner's request;

(21) Performance is weighed against external criteria of relevance, feasibility, etc.

Three expert observers* were selected by the author from the faculty and staff of a graduate school in management to use the LED in selected courses to determine inter-rater reliability. These observers were all familiar with the experiential learning theory underlying this study but none were acquainted with the specific environmental model upon which the LED was based. After each preliminary administration of the LED (with the author plus one expert observer), discussions were taped regarding the difficulties in using the LED, ambiguities in the scale items, etc.

*Professor Irwin Rubin, and Research Associates Mark Plownick and Eric Herzog of the M.I.T. Alfred P. Sloan School of Management.
Ten courses considered representative of the Department of Landscape Architecture (DLA) curriculum were then observed by the author with the LED. These courses differed in terms of lecture/seminar versus studio, required versus elective, closed to DLA students versus interdisciplinary, and small versus large. The total number of courses offered during the time of this study was twenty-two. Several were eliminated from consideration due to size of enrollment (N < 6) or logistical problems in being able to observe the actual course in operation.

The total student body of the DLA was given a questionnaire (see Appendix B) concerning their learning styles, perceptions of learning environments, perceived satisfaction and value of courses they were taking, and specific descriptions of these courses. The latter question asked the student to select, for each course he was in, which of four paragraph statements (each describing an affectively, perceptually, symbolically, or behaviorally oriented situation) they saw as "most" characteristic and "second most" characteristic of that course. Student perceptions of their learning situations, regardless of their grades or level of achievement, have been found to be accurate indicators in other attempts to measure aspects of learning environment (e.g. Costin, et. al., 1971; Schein and Hall, 1969).

Finally, selected faculty were interviewed to discern perceptions of their course's distinguishing characteristics and events, its major goals or objectives, their own role in the course, the degree of pre-planning and structuring that occurs, necessary support resources, and how they evaluate their students (see Appendix C).
Results

A. Questionnaire Response

Of the 88 full-time graduate students enrolled in the DLA, 40 responded with usable questionnaires. While this overall response rate (45%) is disappointing, it is due in large part to the third year class as opposed to the total student body in general. In the first year class, 10 of 13 or 77% responded and in the second year class, 18 of 35 or 51% responded, while only 12 of 35 or 34% of the third year class responded. These trends may have occurred for the following reasons:

(1) The ten courses observed were typically the larger ones that were required of first and second year students.

(2) Third year students are all engaged in some individual research or application project that often requires them to be away from the general physical area (classrooms, studios, and administrative offices) where the observers and author had most of their personal contact with the students;

(3) There were no formal mechanisms to hand out questionnaires; no two or three courses covered the entire enrollment such that the questionnaires could be administered and collected during a class session. This, plus the fact that there was little formal class time available at the end of the term when this study took place, caused the author to personally hand out the questionnaires, one by one, to as many students as could be found. A total of 65 were handed out in this manner and the remaining were mailed out with a personal cover note attached.
B. Reliability

Three different pairs of observers administered the LED in three different courses. The reliability results are shown in Table 2. The degree of observer agreement (A = author; B, C, D = expert observers) for these trials appears quite satisfactory, with 83% of the total pairs of observations being within one point of each other and 96% being within two points on a seven point scale. A more important indicator may be the number of pairs of observations that differed in basic direction or trend on any particular scale. The implicit medium or neutral degree on all scales was "4." The number of pairs of observations differing in direction, $x < 4, y > 4$, was seven or 12%, regardless of the spread in points (e.g. 3-5 or 2-6).

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<th>% of total pairs of observations</th>
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<td>A &amp; C</td>
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<td>5 pts.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

The reliability of an observational tool is often taken to be only the degree of inter-rater agreement (McGraw, et. al., 1972) or data like
that in Table 2. Weick (1968) includes test-retest measures as also
critical to the development of a reliable observation scheme. The extent
that observations are replicable or consistent over time indicates the
degree to which the object in question is functioning in a nonrandom
fashion. This is very important to this study, for although learning
environments (courses) will certainly vary from time to time, our model
posits them to be subject to "typing" or to some degree of generalization
over time. It is therefore necessary to look at test-retest and intra-
rater reliability. Table 3 shows the results of two administrations of
the LED, each spaced three weeks apart, in two different courses.

Again, there appears to be satisfactory stability of observer mea-
sures indicated by the first row in Table 3 and stability of the instru-
ment itself, as indicated by the second row in the table. The inter-rater
reliability indicated is also similar to that in Table 2, with 90% of the
pairs of observations in row two agreeing within one point on a seven
point scale.

<table>
<thead>
<tr>
<th></th>
<th>Difference Between Ratings</th>
<th>Total Pairs of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 point scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1 pt</td>
</tr>
<tr>
<td>First Course:</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Same Observer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Course:</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Different</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of Total Observations

|                        | 66.7 | 23.8 | 7.5  | 0    | 2    | 100 |

Table 3. Test-Retest Reliability
C. Intra-rater Reliability

The intra-rater reliability measures in row one of Table 3 also begin to indicate that the LED tool is measuring what it is supposed to. If one observer achieves consistent agreement through several observations of the same course, two things can be concluded:

(1) he is consistent in his interpretation;

(2) the object (course) is behaving in some nonrandom fashion. This latter point is apparent from the second row in Table 3 where two different observers (both from the group that produced the results in Table 2) achieved high agreement through rating the same course at different times.

D. Interviews with Observers

Discussions between the author and the three observers immediately after the trial observations reported in Tables 2 and 3 served to identify three issues that could lead to both reliability and validity problems with the Learning Environment Diagnostic.

The first issue stems from the definition of the course as the unit of analysis rather than a single classroom session. All observers reported some difficulty in inferring total course characteristics from momentary behaviors. If it was not stated in course outlines or by the instructor, the observer often had to ask about how a particular activity he was watching related to past and future events: how similar it was, how dependent it was on past events, how often it occurs, etc. The fact that all observers reported having to do this, and that they still came up with a relatively strong degree of agreement suggests that it is possible to infer general trends from one or two site observations. If this does hold true, it suggests the person, at any point in time, is
probably reacting to an environment he perceives based on some generalized interpretation of past events and future expectations as well. In other words, if the learner is thought to be reacting to high-inference factors, then it seems appropriate that those measuring the environment should attempt to do the same.

Closely related to the inference of total characteristics from singular events was the issue of having to verbally ask questions in order to fill out some of the LED scales. None of the observers, including the author, found it possible to complete the LED for any course without asking both the instructor and students for additional information. Particularly with the items on the scales relating to Affective environments, it was difficult to infer how students "felt" without asking them about the purpose or usefulness of something and then listening to their responses for cues. A common approach among the observers was to just approach a student at his studio workbench and to ask him to describe what it was he was involved in. An interaction would then take place, usually indicating how that particular activity came about, what was achieved by it, when it was due, whether or not it was satisfying, etc. The problem with this approach is that all students will not agree, nor will all be willing to talk to a polite stranger. Yet, if the results discussed below do begin to suggest that the LED is measuring learning environments similar to how students perceive them, then it appears that this strategy of randomly talking to the instructor and a few students can lead to generally valid inferences. In the preliminary testing of the LED, generally consistent inferences were made by observers even when they had to ask questions of people in the environment.
For affective indicators, where the observers said they most needed to ask people some questions, there was no basic difference in degree of agreement among observers: no greater variance than in ratings of indicators of the other types of environments.

The third issue brought out in the observer discussions concerned the use of multiple referents or several "e.g.'s" for any one scale item in the LED. While all the observers agreed that these behavioral examples were helpful, they were troubled by having to weigh the strong existence of one example versus the mild or little existence of several of the examples. For example, under the Teacher Role items in the LED, one scales item asks: "How often is teacher nondirective or intuitive (e.g. teaches via insight or understanding; answers questions with questions, is nonevaluative; suggests versus critiques; is seen as a guru, visionary, creative, etc.)?" If the subject is a lot of one but not another, is this greater than being a little of each? No resolutions of this dilemma occurred amongst the observers during this study. Again it appears that, using whatever internal "averaging" process they each had, they were able to reach general agreement in terms of rating scores. It does seem necessary, however, to examine more closely each scale in the LED in terms of its indicators or examples to see if, in fact, the scale may not be relating to the overall construct because a few of the specific examples cited may, in fact, be opposites or in competition with one another.

E. Validity

Three indicators of validity were initially considered. The first consisted of comparisons between course measures using the LED and
descriptive analyses of the same course environment (taken from observer records and instructor interviews). Any consistency between LED measures and descriptions of the course was taken to be initial indication of the face validity of the constructs (environmental orientations) that make up the model underlying the LED tool. Secondly, LED measures for each of ten courses were compared with student perceptions of the basic orientation(s) of these same courses. Consistency between these two types of rankings would support the validity of the environmental model being postulated here with respect to its ability to describe an environment in ways commensurate with how those in that environment also see it. Finally, the validity of the behavioral indicators making up each of the four types of environmental orientation was examined by looking at the "clustering" of the intercorrelations between these variables. As in a factor analytic procedure, the intent here was to justify the hypothetical groupings of variables under each of the environmental "types."

Descriptive Analyses

The results of the observer measurement of ten course environments are shown in Table 4. Before comparing these measures with student perceptions, the following synopses of some of the courses are presented in order to examine the face validity of these scores. Each description is based on two sources: (1) observer notes at time of administering the LED tool; and (2) verbatim quotes or paraphrases from interviews with the course instructor (see Appendix C for interview format).
Table 4. Environmental Measures of Ten Landscape Architecture Courses.

<table>
<thead>
<tr>
<th>COURSES OBSERVED</th>
<th>OBSERVER RATINGS OF THE ENVIRONMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AFF.</td>
</tr>
<tr>
<td>COURSE A: Required, introductory studio course in site planning. Heavy emphasis</td>
<td>23</td>
</tr>
<tr>
<td>on studio work - small groups and individuals.</td>
<td></td>
</tr>
<tr>
<td>COURSE B: Follow-up studio project to Course A. Individual work with guest</td>
<td>24</td>
</tr>
<tr>
<td>faculty who actually worked on same or similar project.</td>
<td></td>
</tr>
<tr>
<td>COURSE C: Advanced studio course in site planning. Mixture of group and</td>
<td>24</td>
</tr>
<tr>
<td>individual work. Progress reports presented in large class sessions. Some</td>
<td></td>
</tr>
<tr>
<td>lecturetes.</td>
<td></td>
</tr>
<tr>
<td>COURSE D: Introductory studio course in large-scale developmental site</td>
<td>9</td>
</tr>
<tr>
<td>planning using analytical modeling and simulation techniques. Work in</td>
<td></td>
</tr>
<tr>
<td>competitive teams.</td>
<td></td>
</tr>
<tr>
<td>COURSE E: Follow-up studio to Course D. Use of computer modeling and simulation</td>
<td>11</td>
</tr>
<tr>
<td>to plan long-range development of region site. Interdisciplinary groups compete.</td>
<td></td>
</tr>
<tr>
<td>COURSE F: Weekly seminar course on the design, planning, and management of a</td>
<td>15</td>
</tr>
<tr>
<td>professional practice. Weekly case studies. Term paper.</td>
<td></td>
</tr>
<tr>
<td>COURSE G: Weekly seminar/lecture series with presentations by invited</td>
<td>14</td>
</tr>
<tr>
<td>practitioners in the field. No outside work assignments.</td>
<td></td>
</tr>
<tr>
<td>COURSE H: Lecture/project course for advanced students on the knowledge and</td>
<td>15</td>
</tr>
<tr>
<td>methodology concerning analysis of natural resource inherent to a site.</td>
<td></td>
</tr>
<tr>
<td>COURSE I: Lecture/research course on the historical preservation of gardens and</td>
<td>20</td>
</tr>
<tr>
<td>other landscapes. Individual research projects.</td>
<td></td>
</tr>
<tr>
<td>COURSE J: Seminar/research course on the use of aerial photography in site</td>
<td>18</td>
</tr>
<tr>
<td>analysis and planning individual projects.</td>
<td></td>
</tr>
</tbody>
</table>

*Underline indicates predominant type of environmental orientation.
A. A Behaviorally Oriented Environment: Course A

LED Scores: Affective 23
Perceptual 18
Symbolic 11
Behavioral 28

This course is an introductory, required course to explore and develop primary skills in site planning and design. It is primarily a studio course in that learners spend most of their time (about 70-80%) at their work desks in the studio as opposed to being in a classroom. Classroom sessions are held primarily for progress reports on projects, presentations of completed work, general orientation to a problem definition regarding the particular site being studied. Learners work in teams of three to four persons on different design problems associated with the same overall landscape area. The area under study is an actual river basin in a nearby community so field trips or site visits are conducted as part of the course. The class organizes itself to collect necessary information about the site, unless it has been provided by the instructor. To obtain data on costs of different types of land fill material for example, one class member is selected to go to the library to get information or references for everyone. In the studio, the learner teams are essentially on their own. They discuss how to approach their part of the problem, different alternatives, etc. and will work both independently on subtasks or all together on a final product. The instructor is primarily available to offer assistance on request. Sometimes he makes "desk crits" or rounds where he will spend time reviewing the work of each team. His comments are mostly nondirective; instead of saying,
"I'd do this or that," he would probe or imply other alternatives with a question, "Did you consider this...?" Much of the discussion between learners and between the instructor and the learners is about their personal ideas, values, and attitudes about the land use in question. The culmination of the course is the presentations by the teams to the entire class, the instructor, other invited faculty, and outside professionals or users involved in the site being studied. These are classroom sessions led mostly by the students. Visual aids are used a lot and presentations by students are very personalized: "I thought it would be good to build a ..."; "I wanted to develop the area for elderly users..."; etc. There are no exams or papers. The students' grades are based on their products and the instructor's sense of how professional or realistic their work was. The students appear to worry about grades and often to be frustrated with a seeming lack of direction or "yes versus no" response from the instructor.

From the instructor's point of view, he is trying to "convey the art of landscape architecture" in this course. He wants to simulate a real, professional situation to see how the student deals with the responsibility and ambiguities. He recognizes that some students may wish more direction or more answers but feels that after-the-fact they will learn more from having to act on their own: "Unlike some of my colleagues here on the faculty, I believe this is an art, an intuitive process that you only get by experience...You probably found some students upset at my style. I don't give answers. I ask questions. I want them to think and my questions help them to think like professionals." His major criteria for grading performance is professionalism: "How well they conceptualized
and presented their problem...How likely I would be to hire them into my firm or recommend them to others."

Finally, the instructor’s perception of his role compared with the observer's rating is shown below: (Scale = "1" never, "4" sometimes, "7" always.)

<table>
<thead>
<tr>
<th>Role:</th>
<th>Instructor Rating</th>
<th>Observer Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondirective</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Coach/helper</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Organizer/taskmaster</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Leader-by-example</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Final authority, expert</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Since most observer ratings agree well with the instructor's, the large discrepancy over the last indicator may be due to the instructor's values about what constitutes "expertness." He may feel he is more an expert at what he does versus an expert authority in specific knowledge about some subject which the observer is keying on.

B. A Symbolically Oriented Environment: Course D

LED Scores: Affective 9  
             Perceptual 12  
             Symbolic 31  
             Behavioral 23  

This course was the second term of a one-year course focusing on the theories of planning and design and their application to land systems using conventional and computer analysis methods. The major emphasis in
the course appeared to be on developing skills in, and appreciation of, the use of computer technology to manipulate multiple variables in a large-scale site development project. Many class sessions began with instructor input on either specific computer data (codes, programming hints, etc.) or on various variables necessary to conceptualize a problem. Student teams would then return to the studio to review printouts, translate computer information to visual displays, plan next steps using the computer, or discuss problems in their approach that the computer printout had detected. Each team was competing with the rest of the class, with the instructor team as the judges at various steps or stages of problem definition, analysis and solution. Through the computer, the faculty would introduce constraints and variables relevant to the problem (i.e. decreasing business zoning, or receding shore line, etc.). Discussions in the teams centered on interpretation of data, planning for next computer runs, and improving skills in programming and using the computer system. The faculty was ever present in the classroom and in the studio. Their inputs were mainly concerned with logistics (when the next run was due, a coding change, why the printout was late, etc.), and with telling students what their results meant or implied in practical terms: "You increased this type of zoning and the computer is telling you the result was to knock out all middle income housing." The classroom portions of the course were mostly lectures by the faculty. All sessions started on time and an emphasis was put on adhering to a schedule of events. Grades were determined according to a point system set up in advance. Points were awarded each time there was a computer run and printout for each team and for a final presentation and problem analysis given by the team.
at the end of the course.

The head of the faculty team responsible for this course describes it as an attempt to give students an appreciation of the complexity of site development problems and skills in integrating the various factors involved. "It is difficult to separate analysis and synthesis, but we try with the aid of the computer. There is a science to problem-solving and we feel we're in the position of selling it to them." He sees this course as a "state of the art" where applied research is valued, perhaps more than artistic skills. "They come from ____'s course with a feel for the traditional aspects of the profession. I don't care about the mainstream; this course will make our students unique." There is a lot of faculty planning and prework to set up the computer programs. "Our goal is clear, but methods and timetables unfold. The students' attendance and adherence to schedules is crucial because we often have to change if the computer is down." In terms of his role, "I see that decisions are made. I'm like a director. I cause things to happen." And regarding evaluation, "Besides their scores, I look for gain in terms of where I thought they were when they came into the class. Attendance is essential. I look for initiative, stick-to-it-ness, and ability to synthesize under pressure."

A comparison between this instructor's rating of his role and the observer's rating is shown below: (Scale = "1" never, "4" sometimes, "7" always.) A major discrepancy occurs around the "leader by example" trait. This instructor probably felt that he exemplified what he wanted his students to be like while the LED tool was keying on the degree to which he used examples from his experiences, role-played a designer, acted like a client, etc.
C. A Perceptually Oriented Environment: Course F

LED Scores: Affective 15  
Perceptual 23  
Symbolic 17  
Behavioral 16  

This course is a seminar on the management of planning and design organizations. It includes students from other design disciplines than landscape architecture, as well as business school students. The class meets once a week and most sessions are case study discussions. Students are expected to read and prepare for a case analysis each week. Sometimes guest discussants are invited who were actually involved in the case problem. The cases are concerned with organizational and managerial issues in real design and planning firms or projects within firms. There is required outside reading each week from an extensive reading list on organization theory. Classroom discussion is primarily between the teacher and individual students. Occasionally, students interact with one another, but answers or comments are usually directed to the instructor. There is a required project or case analysis due at the end of the course.
Students can choose either to write a paper on their own career plans or to do a detailed case write-up. Attendance is sporadic and seems to increase when guests or panels or professionals are scheduled to attend. The course is graded on a pass-fail basis and consequently appears to be a low-pressure setting where only the interested students show up.

From the instructor's point of view, this course is intended to help the students prepare for entry into a professional role. "I try to make them realize the dilemmas they will be facing. They come out of here feeling design is everything, not realizing that it is but a part of a whole package. I try to give them different frameworks for integrating real cases with readings." Regarding his role, he sees himself as a "provocator" trying to intrigue students or make them more appreciative of nondesign issues that impact on the profession. "I try to model an attitude which says that you can have authentic nonexpertise and that this is normal. There are few right answers to the kinds of problems we raise here." With respect to evaluation, the instructor applies two standards: "For those who get turned on, I give a lot of feedback on their term paper and try to evaluate the quality of their thinking. For those who don't, I look at attendance, preparation for class discussions and whether or not they tried to be sincere about course content."

Comparison between this instructor's rating of his role and the observer's rating is shown below:
<table>
<thead>
<tr>
<th>Role</th>
<th>Instructor Rating</th>
<th>Observer Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondirective</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Coach/helper</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Organizer/taskmaster</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Leader-by-example</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Final Authority, expert</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

D. An Affectively Oriented Environment

Of the courses measured using the LED, none were measured to be primarily affective in their orientation. The students’ ratings of the environment did rate Course G as being primarily affective. Possible reasons for this discrepancy will be examined later on. From the results in Table 4, highly affective environments appear to be those where the students perceived their work to be a close simulation of a professional experience and/or where faculty include practicing professionals. Courses A, B, and C had the highest affective scores. Course A, as described earlier, attempts to put students in a real design situation, focuses on an actual site they can visit, and involved people who are actually using or working on that site. Course B is a follow-up to Course A, where students work independently on design projects with practicing alumni of the department as coaches and evaluators. Feedback is one on one and many students develop a peer relationship with a professional landscape architect during the process. One of these "alumni" faculty described his role as a sounding-board rather than an instructor..."Since they have their official faculty member in charge, I'd rather get to know the student and
really help him with details." This was reflected in both his and the observer's ratings of his role:

<table>
<thead>
<tr>
<th>Role</th>
<th>Instructor Rating</th>
<th>Observer Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondirective</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Coach/helper</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Organizer/taskmaster</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Leader-by-example</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Final Authority, expert</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

While Course C does not employ outside practitioners, it does focus on real, nitty-gritty site planning problems. It is an advanced course (taken after Courses A, B, and D) and students are given more attention in terms of one on one "desk crits" with the faculty member in charge. The high affective score may reflect this relationship and the personalized feedback or attention that was observed.

Given these general descriptions of "types" of courses, it does appear that the LED is measuring some basic differences or components of a learning environment. The basic course descriptions and instructor perceptions match well with the predominant orientation measured by using the LED. Some variance does exist, however, between the instructor's self-perception of their predominant role and that measured using the LED. While there is general agreement in the cases sited, the instructors tend to see themselves as a little of everything rather than too much of any one role description. This may be a reaction to implicit values they attribute to the descriptions or a valid representation of
their behavior. If the students also perceive them to be "a little of everything" then this category of indicators will have to be reexamined in terms of the model of environments to be developed here because it may not be accurately differentiating instructor behavior as intended.

In addition, there appears to be support for the notion of environmental complexity introduced in Chapter II. The absolute scale scores from the LED indicate a mixture of orientations in learning environments. While Course A was described under an example of a Behavioral Environment, it would also appear to be quite affectively oriented as well. The earlier descriptions of the course seem to support this. Course E offers another example of complexity. It is a follow-up to the computer oriented Course D described in detail earlier. Thus it appears to be strongly symbolically oriented like Course D, but in addition much more perceptually oriented. This added complexity may be due to the fact that in Course E the student is asked to do more reading, data collection, and strategizing before using computer techniques on a problem, whereas in Course D these elements were given to him so he could focus more on mastering the skills and terminology needed to use the computer. Also, in Course E, as the instructor put it, "One goal here is to get them to evaluate the usefulness of computer technology versus other approaches for themselves...Last term we sold it to them so they'd learn it; now I want to know which approach they really think is better." Thus an emphasis on taking multiple perspectives to the same problem appears to exist: one of the indicators of a perceptual orientation.
Environmental Measures and Student Perceptions

Learner ratings of their courses were compared with independent observer measures of the same courses as an indicator of both the face validity of the overall model and the construct validity of the orientations proposed in the previous chapter. Each student was asked to indicate which of the following statements "most characterized" and "next most characterized" each of the courses they were enrolled in.

Statement 1

The course is an opportunity for me to understand the relationships between concepts or to create conceptual relationships from basic information. A lot of time is spent discussing and comparing ideas, methods, etc. with other students or the teacher. There is a lot of time where I have to listen, read or watch in order to better understand something. I am really learning how to define or approach a problem. The teacher is mostly there to give insights and to help me discover for myself. It is more important for me to understand my own criteria or hypotheses about an issue than to be evaluated for solving it.

Statement 2

The course is an opportunity for me to practice and develop my practical skills as a professional. A lot of time is spent actually doing some task that requires me to apply what I've learned. The task is usually a real-life problem where I am left to define my approach, schedule my own time to work on it, make my own assumptions, take my own initiative, etc. The teacher is there for advice and coaching, but rarely forces me to act one way or the other. My work is evaluated according to practical criteria like outside professionals' opinions, real clients' views, feasibility, sellability, etc.

Statement 3

The course is an opportunity for me to improve my conceptual problem-solving skills. A lot of the information is abstract — having to do with past events, future hypotheses, or scientific methods of doing work. I do a lot of writing, reading, interpreting graphs, listening to lectures, etc. in order to solve a problem. It is important to memorize terms and data for recall, learn special jargon, have special skills (e.g. graphical, computer) and to have schedules or guidelines available for solving the problem because of its complexity. The teacher organizes the activities, explains and enforces complex procedures, and/or determines which answer is right or best. He/she is the one who interprets the field of knowledge being dealt with in the problem and more or less "guides us through uncharted waters."
Statement 4

The course is an opportunity for me to examine or realize my attitudes and feelings about the profession, about certain methods or skills, or about a specific problem or project. Most of the focus is on what is going on at the present -- how I react to things, what I feel like when I'm doing something, designing or creating at my desk. The teacher is like a colleague who helps me set my own goals and gives personalized feedback. The activities in the course engage me totally -- with my gut as well as my head -- so that I can really feel what it's like to be a professional.

These statements corresponded with environments that would have shown up on the LED as Perceptually, Behaviorally, Symbolically, and Affectively oriented, respectively. Table 5 compares the student rankings of their courses to observer rankings made with the LED. The LED rankings were assigned based on the differences among total scale scores for each course. An "affective score," for instance, is the sum of scores on five specified scales (numbers, 3, 5, 12, 16, and 18).

There appears to be general agreement between the LED ratings and student perceptions. In nine of the ten courses, the LED results indicate a dominant environmental type. The student perceptions agree with this type in six of these nine cases. In the other three of these cases, Courses D, G, and J, the highest rated environmental type by the LED was the second highest ranked by the students. In Course H, the tenth case, the LED characterized the environment as being equally perceptual and symbolic, while the students rated it as highest in perceptual orientation and next highest in symbolic orientation.

Disagreement occurred over Courses D, G, and J. In Course D the students did not see their introduction to the use of computer methods for modeling the design process as mainly symbolically oriented, but rather as more perceptually oriented. Perhaps the introductory/overview nature
Table 5. Comparisons Between Observer Ratings and Student Perceptions of the Environment in Ten Courses.

<table>
<thead>
<tr>
<th>COURSES OBSERVED:</th>
<th>OBSERVER RANKINGS OF ENVIRONMENTAL ORIENTATION*</th>
<th>LEARNER RANKINGS OF ENVIRONMENT*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AFF.</td>
<td>PERC.</td>
</tr>
<tr>
<td>COURSE A: Required, introductory studio course in site planning. Heavy emphasis on studio work -- small groups and individuals. N=9 (69)%**</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>COURSE B: Follow-up studio project to Course A. Individual work with guest faculty who actually worked on same or similar project. N=15 (62)%</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>COURSE C: Advance studio course in site planning. Mixture of group and individual work. Progress reports presented in large class sessions. Some lecturetes. N=6 (60)%</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>COURSE D: Introductory studio course in large scale developmental site planning using analytical modeling and simulation techniques. Work in competitive teams. N=16 (57)%</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>COURSE E: Follow-up studio to Course D. Use of computer modeling and simulation to plan long-range development of region site. Interdisciplinary groups compete. N=5 (36)%</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
COURSE F: Weekly seminar course on the design, planning, and management of a professional practice. Weekly case studies. Term paper. N=6 (40%)  
| 3 | 1 | 2 | 3 | 2 | 1 | 3 | 4 |

COURSE G: Weekly seminar/lecture series with presentations by invited practitioners in the field. No outside work assignments. N=13 (55%)  
| 2 | 1 | 3 | 4 | 1 | 2 | 3 | 4 |

COURSE H: Lecture/project course for advanced students on the knowledge and methodology concerning analysis of natural resource, inherent to a site. N=7 (47%)  
| 3 | 1 | 1 | 4 | 3 | 1 | 2 | 4 |

COURSE I: Lecture/research course on the historical preservation of gardens and other landscapes. Individual research projects. N=4 (57%)  
| 2 | 1 | 2 | 4 | 4 | 3 | 2 | 1 |

COURSE J: Seminar/research course on the use of aerial photography in site analysis and planning. Individual projects. N=6 (86%)  
| 3 | 2 | 3 | 1 | 4 | 1 | 3 | 2 |

Underline indicates predominant type of environmental orientation

*Rankings: 1 = most characteristic, 4 = least characteristic

LED "ranks" were arbitrarily assigned in correspondence to the relative sum totals of the scale scores relating to a particular type of environment (i.e. the Affective scores = total of scores on scales 3, 5, 12, 16, 18).

Ties are indicated where the LED item score totals for one type of environment exactly equalled the total for another.

**(%) = percentage of total students enrolled in a course.
of this course, as compared to Course E, the follow-up course which they did see as more symbolically oriented, did not give them a chance to really work with the methods, programs, and logical systems to solve problems as much as just see how they work. Using the LED, however, the observer rated this course as the most symbolically oriented of all ten courses measured (see Table 5). The fact that students were being exposed to a new perspective (computer modeling) for the first time, albeit an abstract perspective, may explain their ranking it highest in perceptual orientation: that the new exposure to a way of viewing or solving some problem, or handling of information, may appear as a perceptual stimulus (another perspective) first, no matter the actual nature of the stimulus. Having gained skills in using this new perspective, as students did in Course E, they then experience it for what it is: an abstract, symbol dependent tool which results in their (and the observer's) high symbolic rating.

Course J poses a similar puzzle. Here students are introduced to a new technology (aerial photography) to help plan for land resource development. They are then left to design and carry out projects in a self-directed manner to apply this technique to some real problems. The students, possibly acting under the explanation above, rated this course highest in the perceptual orientation while the observer keyed on the project-focused behavior and rated it highest in its behavioral orientation.

In Course G, the students are exposed to practicing landscape architects who deliver lectures, visual presentations and seminars on a particular project they are, or have been, working on. The LED results keyed on
the listening, observing role of students in this course and the "new perspective" offered by the practitioner to come up with a high score on perceptual orientation. The student rankings, however, appear to have keyed on the "affect" of these practicing professionals on the students. It appears that a lot of role modeling was going on, or in other words, students were more interested in how these outside professionals came across and if they could see themselves doing the same, than in the content or what it was the professionals had to say about a particular problem. Thus the students rated this course highest in its affective orientation and second highest in the perceptual arena.

These results indicate that observers, using the LED indicators, measured courses in relatively the same way that students rated them, using similar indicators. This begins to suggest that, at least for this sample, the LED is capable of measuring learning environments in ways or terms in which learners also can perceive them. The results also raise some questions regarding the definition of some indicators or measures of certain constructs (i.e. Perceptual environments). These questions will be addressed later on, after the original set of LED variables have been analyzed from several perspectives.

Cluster Analysis

To examine the validity of the four types of environmental orientation in our model, correlation matrices were formed from students' perceptions of the degree to which each of the twenty-one behavioral indicators in the LED "generally contributed to their ability to learn" (see questionnaire in Appendix B). Four matrices consisting of the
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To examine the validity of the four types of environmental orientation in our model, correlation matrices were formed from students' perceptions of the degree to which each of the twenty-one behavioral indicators in the LED "generally contributed to their ability to learn" (see questionnaire in Appendix B). Four matrices consisting of the
intercorrelations of the hypothesized indicators for each type of environmental orientation were created using Spearman Rank Order Correlations. While a significant positive correlation of reasonable magnitude between two variables in a given factor, or orientation, would indicate a statistical relationship and support the combining of these variables into a construct or cluster, it does not necessarily mean that each student was applying the same criteria in judging the two variables. To look for the degree of consistency or true clustering based on some common, underlying criterion, Kendall's Coefficient of Concordance, $W$, was computed, for each matrix. This coefficient is used to determine the association between $N$ sets of ranking of $K$ entities. The formula for finding $W$ is (Siegel, 1956):

$$W = \frac{(N-1)(\bar{r}_s) + 1}{N}$$

where $N = \text{number of judges assigning ranks}$

$\bar{r}_s = \text{average rank order correlation among } K \text{ objects}$

The value of $W$ ranges from -1 to +1. Its significance for values of $K$ less than 7, as in our cases, is derived from the distribution of critical values of $s$ (in Siegel's *Nonparametric Statistics*, 1956) where:

$$s = W \left[ \frac{1}{12} - \frac{N^2}{(k^3 - k)} \right]$$

The correlation matrix for the hypothesized Affective construct is shown in Table 6. With seven of the ten correlations being significant and positive this appears to be a consistent factor in the eyes of the total student sample. The degree of underlying agreement is also encouraging with $W = .303$ and $s = 4848$ ($p < .01$). One unexpected relationship is that between the indicators of teacher role (V16) and rules governing student behavior (V12). The negative correlation may indicate that
students are differentiating "model or colleague" from "friend" so that
the teacher-as-model of a professional is also threatening or evaluative
and thus not one with which the student could freely share personal opinions and feelings.

Table 6. Rank-order Correlations Between Hypothesized Indicators of Affectively Oriented Environments.

<table>
<thead>
<tr>
<th>Variables</th>
<th>V3</th>
<th>V5</th>
<th>V12</th>
<th>V16</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3 - Activity focus on &quot;experiencing&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V5 - Source of info. is &quot;here and now&quot;</td>
<td>.44**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V12 - Free to express personal feelings</td>
<td>.42**</td>
<td>.41**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V16 - Identify with teacher as model</td>
<td>.05</td>
<td>.37**</td>
<td>-.24*</td>
<td></td>
</tr>
<tr>
<td>V18 - Feedback based on individual needs</td>
<td>.49***</td>
<td>.35**</td>
<td>.46***</td>
<td>.08</td>
</tr>
</tbody>
</table>

N = 40, \( r_{s} = .28 \), k = 5

* \( p < .05 \)  ** \( p < .01 \)  *** \( p < .001 \)

Table 7 shows the results for the Perceptual construct. This also appears to be a reasonably consistent factor to the students with six of ten correlations being significant and positive. The degree of underlying agreement is also positive and significant with \( W = .271 \) and \( s = 4048 \) (\( p < .05 \)). Of the five hypothesized indicators of perceptually oriented environments, the weakest appears to be the one to do with the intended purpose of major activities (V1). Understanding, as a goal, does not relate to rules for learner behavior (V10) or to teacher role (V13) indicators. To the student, the word "understanding" may be too vague or too encompassing to connote any specific relationship to either his behavior or that of the teacher. If this is true, however, one might expect
similar results in the Symbolic factor with the indicator of "solving a problem" (V2).

Table 7. Rank-order Correlations Between Hypothesized Indicators of Perceptually Oriented Environments.

<table>
<thead>
<tr>
<th>Variables</th>
<th>V1</th>
<th>V7</th>
<th>V10</th>
<th>V13</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1 - Activity focus on &quot;understanding&quot; concepts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V7 - Info. focus on &quot;how&quot; or process of events</td>
<td>.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V10 - Learners encouraged to take on multiple perspectives</td>
<td>0</td>
<td>.30*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V13 - Teacher role is nondirect, intuitive</td>
<td>-.03</td>
<td>.29*</td>
<td>.34**</td>
<td></td>
</tr>
<tr>
<td>V19 - Learner determines own criteria for evaluation</td>
<td></td>
<td>.21</td>
<td>.30*</td>
<td>.40**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.47***</td>
</tr>
</tbody>
</table>

N = 40, \( \bar{s} = .25 \), k = 5

* \( p < .05 \)    ** \( p < .01 \)    *** \( p < .001 \)

The indicators of the Symbolic factor, shown in Table 8, are less correlated with one another than the previous two factors discussed. Only five of fifteen correlations are significant and, in general, the magnitudes are less than in the previous two tables. The W is positive and significant, but small: \( W = .181, s = 4040 \) (\( p < .05 \)). As in the case of the "understanding" indicator (V1) of Perceptual environments, the "solving a problem" indicator (V2) of Symbolic environments appears too vague or encompassing to be related to many of the other indicators. The only exception is a strong positive correlation with the "teacher as an expert authority" (V17) which would be expected. While both indicators of
teacher role, V15 and V17, are related to other symbolic indicators, they are unrelated to one another ($r = .12, \text{n.s.}$). In fact, each tends to correlate significantly with different indicators, except for rules governing learner behavior (V9). This group of variables may be keying on slightly different "subfactors" within a symbolic orientation: V2, V9, and V17 on the one hand and V6, V15, and V20 on the other. This possibility will be examined later on when a similar analysis is done with selected samples of students.

Table 8. Rank-order Correlations Between Hypothesized Indicators of Symbolically Oriented Environments.

<table>
<thead>
<tr>
<th>Variables</th>
<th>V2</th>
<th>V6</th>
<th>V9</th>
<th>V15</th>
<th>V17</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2 - Activity focus on &quot;solving a problem&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V6 - Source of info. is &quot;there and then&quot; -- abstract</td>
<td>-.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V9 - Acts governed by rules of inference, jargon</td>
<td>.16</td>
<td>.23*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V15 - Teacher role is taskmaster -- organizer</td>
<td>.05</td>
<td>.34*</td>
<td>.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V17 - Teacher role is expert/final authority</td>
<td>.29*</td>
<td>-.04</td>
<td>.29*</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>V20 - Performance evaluated against &quot;right&quot; answer</td>
<td>.08</td>
<td>.14</td>
<td>-.03</td>
<td>.40*</td>
<td>.13</td>
</tr>
</tbody>
</table>

$N = 40, \sqrt{s} = .16, k = 6$

* $p < .05$  ** $p < .01$

Finally, the correlations between hypothesized indicators of the Behavioral construct in our model are shown in Table 9. This is the least consistent, and hence least valid via this analysis, of the four
constructs in the model. Only three of ten correlations are significant while six are in the ±.10 range in magnitude. The degree of underlying agreement is \( W = .151 \) with \( s = 2432 \) (\( p < .05 \)). While this \( W \) indicates minimal degree of overall agreement, there is no strong variable which relates well to all others. It appears that this construct needs either more clear/specific indicators or reconstruction with other of the twenty-one total indicators being used in the model. Both these possibilities will be examined when a similar analysis is done with selected samples.

Table 9. Rank-order Correlations Between Hypothesized Indicators of Behaviorally Oriented Environments.

<table>
<thead>
<tr>
<th>Variables</th>
<th>V4</th>
<th>V8</th>
<th>V11</th>
<th>V14</th>
</tr>
</thead>
<tbody>
<tr>
<td>V4 - Activity focus on application of skill to practical problem</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V8 - Information focus on getting task done</td>
<td>.56***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V11 - Present learner acts influences future behavior</td>
<td>.22</td>
<td>-.02</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>V14 - Teacher role is as coach/helper</td>
<td>.06</td>
<td>-.04</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>V21 - Performance evaluated against real life constraints</td>
<td>.08</td>
<td>.16</td>
<td>-.03</td>
<td>.31*</td>
</tr>
</tbody>
</table>

\( N = 40, \bar{r} = .13, k = 5 \)

* \( p < .05 \)  ** \( p < .01 \)  *** \( p < .001 \)

Summary

This chapter has reviewed the creation and initial testing of a Learning Environment Diagnostic (LED) tool based upon the theoretical model postulated in Chapter II. The LED consists of twenty-one scales used by an observer to rate a course. The scale scores are grouped and
summed to give four scores indicating a course's Affective, Perceptual, Symbolic, and Behavioral orientation.

After initial trial observations to obtain reasonable reliability, the LED was used to measure ten courses in a graduate department of landscape architecture. When LED results are compared to descriptions of the courses by observers and instructors, and to student ratings of these courses, there was general agreement. The observation instrument matched the student ratings of the predominant orientation of the courses in seven of ten cases. The LED scores also gave support to the notions of environmental "sophistication" when compared amongst courses and to "complexity" when compared with descriptive analyses of the courses in the sample.

Finally, each type of environmental orientation or construct in the model described in Chapter II was examined for internal validity using Spearman Rank Order correlations and Kendall's Coefficient of Concordance. The Affective and Perceptual constructs appear to be most consistent and widely shared as such by the students returning questionnaires. The Perceptual factor could perhaps be strengthened with the addition of some indicator to do with "exposure to a new way of thinking or handling data."

The analysis of LED and student ratings suggested this situation was incorrectly measured as a symbolic or behavioral aspect, depending upon the content of the new approach. The Symbolic construct was less consistent than the above two and may, in fact, currently be measuring two different "subfactors" or types of symbolic situations. One appears to be a mix of perceptual and symbolic notions: working with abstractions in ways or protocols guided by the instructor to reach solutions that are right or wrong depending on absolute tests inherent in that field of knowledge.
The other sounds more like a behavioral-symbolic mix: solving problems using strict methods governed by rules of inference, terminology, and adjudicated by an expert or final authority who interprets the body of knowledge being studied. The last construct, the Behavioral factor, appeared weak in terms of the internal relationships among its five indicators.

Before concluding what to accept, reject, or reconstruct in each of the environmental constructs, this study will go a step further in testing the basic model and the notion that one can observe an environment and accurately measure it in terms commensurate with how those in that environment perceive it. The model is also based on the premise that different types of learners will relate to different aspects of the same situation and so our model has to be able to differentiate learning environments in these terms as well. That is, while it is expected that a general student population would be able to perceive environmental differences in the four domains proposed in the model, certain types of learners should also value one or more types of environmental orientation over another. The next chapter will expand on a theory of learning and learning style differences. Data from the student sample used in this chapter will then be broken up according to learner style and reanalyzed with the LED scores and constructs in subsequent chapters before final conclusions are considered.
Individual Learning Styles

In order to understand person-environment interactions in learning situations, it is necessary to conceptualize the learning process in such a way that individual differences can be identified. A model of learning environments then, to be useful, has to measure environments in terms commensurate with these different ways in which learners learn. To further examine the validity of the model of learning environments being developed in this study, this chapter will present a theory of and methodology for measuring learning style differences. Future chapters will then focus on tests for relationships between learning styles and environmental measures.

A Theory of Experiential Learning

For the purposes of this study, Kolb's experiential learning theory was used. The basic premise of this theory is the description of a learning cycle where experience is translated into concepts which, in turn, are used as guides to choices of behaviors and, hence, new experiences (see Figure 6). The use of the adjective "experiential" is to emphasize the crucial role that experience plays in the learning process, an emphasis that differentiates this approach from others like Hunt (see pages 24-25, Chapter I) who emphasize only the cognitive functions. In Kolb's cycle, immediate concrete experience is the basis for observation. These observations are assimilated into a "theory" from which new implications for action can be deduced. These implications or hypotheses then serve as guides in acting to create new experiences. The learner thus needs four
different kinds of abilities — Concrete Experience abilities (CE), Reflective Observation abilities (RO), Abstract Conceptualization abilities (AC), and Active Experimentation abilities (AE). That is, he must be able to involve himself fully, openly, and without bias in new experiences (CE); he must be able to reflect on and observe these experiences from many perspectives (RO); he must be able to create concepts that integrate his observations into logically sound theories (AC); and he must be able to use these theories to make decisions and solve problems (AE).

More specifically, there are two primary dimensions to the learning process. The first dimension represents the concrete experiencing of
events at one end and abstract conceptualization at the other. The other
dimension has active experimentation at one extreme and reflective obser-
vation at the other. Thus, in the process of learning, one moves in varying
degrees from actor to observer, from specific involvement to general
analytic detachment.

**Individual Learning Styles**

Over time, forces operate on individuals in such a way that choices
between sets of opposite abilities on each of the two primary learning di-
mensions tend to occur in characteristic fashions. Thus, through heredi-
tary equipment, past life experiences, and present environmental demands,
most people develop strengths, or preferred styles that emphasize one set
of learning abilities over another.

Kolb has drawn from the work of cognitive psychologists (e.g. Flav-
vell, 1963; Bruner, 1966; Harvey, Hunt, Schroder, 1961) and of develop-
mental psychologists (e.g. Piaget, 1952; Kagan, et. al., 1964) in defining
four distinct learning styles. Each style is in contrast and dialectic
tension with its opposite pole on the two primary dimensions of learning
modes (abstract-concrete and active-reflective). Thus four types of
learners are defined based on their predominant learning styles:
the Accommodator, the Diverger, the Assimilator, and the Converger (see
Figure 7).

The **Accommodator**'s dominant learning abilities are Concrete Experi-
ence (CE) and Active Experimentation (AE). His greatest strength lies in
doing things, in carrying out plans and experiments and involving himself
in new experiences. He tends to be more of a risk-taker than people with
the other three learning styles. Kolb has labelled this style "accommodator" because he tends to excel in those situations where he must adapt himself to specific immediate circumstances. He tends to solve problems in an intuitive trial and error manner (Grochow, 1973), relying heavily on other people for information rather than his own analytic ability (Stabell, 1973). He is comfortable working with people but is often seen as impatient or "pushy."
The **Assimilator** has the opposite learning strengths of the accommodator. He is best at Abstract Conceptualization (AC) and Reflective Observation (RO). His greatest strength lies in his ability to create theoretical models. He excels in inductive reasoning: in "assimilating" disparate observations into an integrated explanation (Grochow, 1973). He is less interested in people and more concerned with the practical use of theories. For him it is more important that the theory be logically sound and precise. As a result, this learning style is more characteristic of the basic sciences and mathematics rather than the applied sciences. In organizations this learning style is found most often in the research and planning departments (Kolb, 1976; Strasmore, 1973).

The **Converger's** dominant learning abilities are Abstract Conceptualization (AC) and Active Experimentation (AE). His greatest strength lies in the practical application of ideas. A person with this style seems to do best in those situations like conventional intelligence tests where there is a single correct answer or solution to a question or problem (Torrealba, 1972). His knowledge is organized in such a way that, through hypothetical-deductive reasoning, he can focus it on specific problems. The label "converger" is drawn in large part from Liam Hudson's (1966) research in this style of learning (using different measures than the LSI) which shows that convergers are relatively unemotional, preferring to deal with things rather than people. They tend to have narrow interests, and choose to specialize in the physical sciences. This learning style is also characteristic of many engineers (Kolb, 1976).

The **Diverger** has the opposite learning strengths of the converger. He is best at Concrete Experience (CE) and Reflective Observation (RO).
His greatest strength lies in his imaginative ability. He excels in the ability to view concrete situations from many perspectives and to organize many relationships into a meaningful "gestalt." Kolb has drawn the "diverger" label from Hudson's (1966) research findings that a person of this type performs better in situations that call for generation of ideas such as a "brainstorming" idea session. Divergers are interested in people and tend to be imaginative and emotional. They have broad cultural interests and tend to specialize in the arts. This style tends to be characteristic of persons with humanities and liberal arts backgrounds.

Measuring Individual Learning Styles

The Learning Style Inventory (LSI) was developed by David Kolb (1971) to measure an individual's relative strengths on the concrete-abstract and active-reflective learning dimensions. The form of the LSI is a nine-item, self-descriptive questionnaire. Each item asks the respondent to rank order four words in a way that best describes his learning style. One word in each item corresponds to one of the four learning modes -- Concrete Experience (sample word feeling), Reflective Observation (watching), Abstract Conceptualization (thinking), and Active Experimentation (doing).

The LSI measures an individual's relative emphasis on four learning abilities -- Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE), plus two combination scores that indicate the extent to which an individual emphasizes abstractness over concreteness (AC-CE) and the extent to which an individual emphasizes action over reflection (AE-RO). The inventory, along with scoring instruction, is shown in Appendix D.
The words used in the Learning Style Inventory items were selected from a longer list of words created by a panel of four behavioral scientists acquainted with experiential learning theory. The final version of the LSI has been refined through item analysis to include only six scored words that individually correlate best with the total score on each mode (see Kolb, 1976). No word was included in the final six if it correlated less than .40 with the total mode score.

**Actual Words Scored for Each Learning Mode in the LSI**

<table>
<thead>
<tr>
<th>Concrete Experience</th>
<th>Reflective Observation</th>
<th>Abstract Conceptualization</th>
<th>Active Experimentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive</td>
<td>Tentative</td>
<td>Analytical</td>
<td>Practical</td>
</tr>
<tr>
<td>Feeling</td>
<td>Watching</td>
<td>Thinking</td>
<td>Doing</td>
</tr>
<tr>
<td>Accepting</td>
<td>Observing</td>
<td>Evaluative</td>
<td>Active</td>
</tr>
<tr>
<td>Intuitive</td>
<td>Reflecting</td>
<td>Logical</td>
<td>Pragmatic</td>
</tr>
<tr>
<td>Present-Oriented</td>
<td>Observation</td>
<td>Conceptualization</td>
<td>Experimentation</td>
</tr>
<tr>
<td>Experience</td>
<td>Reserved</td>
<td>Rational</td>
<td>Responsible</td>
</tr>
</tbody>
</table>

**Intercorrelation of LSI Scales**

As has been mentioned, experiential learning theory would predict that Concrete Experience (CE) would be negatively correlated with Abstract Conceptualization (AC), and that Active Experimentation (AE) would be negatively correlated with Reflective Observation (RO). Other correlations should be near zero. Intercorrelations of the scale scores for a sample of 807 people shows this to be the case. This sample is described in Kolb (1976). CE and AC were negatively correlated (−.57, p < .001).
RO and AE were negatively correlated (-.50, p < .001). Other correlations were low but significant because of the large sample size (CE with RO .13, RO with AC -.19, AC with AE -.12, and AE and CE -.02). All but the last are significant at p < .001. As a result of the intercorrelations two combination scores were created to measure the Abstract/Concrete dimension (AE minus CE) and the Active/Reflective dimension (AE minus RO). With the Abstract/Concrete dimension the Concrete Experience (CE) score correlated -.55 and the Abstract Conceptualization (AC) score correlated .90. With the Active/Reflective dimension Active Experimentation (A") correlated .85 and Reflective Observation (RO) correlated -.84. Thus Kolb was justified in treating CE and AC, and AE and RO, as pairs of independent variables from which two summary scores (AC minus CE and AE minus RO) could be derived and used for "typing" on a two-dimensional grid (discussed later on).

**LSI Reliability and Validity**

The test-retest reliability, or stability over time, of the LSI has been the subject of much debate. The most recent analysis, by Plovnick (1974), suggests at best only moderate statistical reliability in this area. Since the LSI does not measure independent psychological traits assumed to be fixed and unchanging, traditional test-retest statistics may not be the appropriate methods of analyzing reliability. A more detailed discussion of these issues and concerns is included in Appendix E.

For the purposes of this study, the LSI was used primarily because of its face validity in measuring individual learning styles and relating
these to undergraduate college majors (Kolb, 1971), to academic specialization in graduate school (Plovnick, 1971; Kolb, 1973), and to subject matter/departmental differences and similarities across undergraduate curricula (see discussion of Biglan, 1973 and Kolb, 1971 in Chapter II, pages 44-46). A more detailed review of these findings is also included in Appendix E.

Preliminary investigations have also shown the LSI to be useful in relating learning styles to different learning situations. Table 10 shows the correlations between LSI scale scores and ratings (on a 1 to 7 scale) by 144 Harvard MBA students of how much each learning situation listed facilitated their learning. Although generally small, these correlations tend to support basic relationships one would predict from the experiential learning model. Concrete learners tend to find theoretical readings unhelpful, but "here and now" feedback from peers helpful. Reflective observers find that listening and digesting lectures is helpful. Abstract learners report learning best from case studies, theoretical readings and thinking alone, but find simulation exercises and talks by expert practitioners unhelpful. Active experimenters appear to learn best from projects and homework where they can apply new knowledge and skills. Lectures are not helpful to them, probably due to the lack of any self-initiated, active role they can assume in them.

The fact remains, however, that in Table 10 many correlations are negligible where one would have expected significant relationship (see underlines in Table 10). This may be due to inability of the LSI to differentiate learners in ways that relate to learning situations, or to the type and level of situational factors listed. One thesis of this study is
Table 10. Product-Moment Correlations between Learning Style Inventory Scores and Harvard MBA Student Ratings of Situations That Facilitate Their Learning (n = 144).

(Underline denotes author's expected positive relationships)

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
<th>AC-CE</th>
<th>AE-RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>.04</td>
<td>.18*</td>
<td>-.05</td>
<td>-.25***</td>
<td>-.04</td>
<td>-.24***</td>
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<td>Seminars</td>
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<td>-.07</td>
<td>-.10</td>
<td>-.01</td>
<td>-.08</td>
<td>-.04</td>
</tr>
<tr>
<td>Case Studies</td>
<td>-.03</td>
<td>-.12</td>
<td>.22**</td>
<td>.09</td>
<td>.09</td>
<td>.11</td>
</tr>
<tr>
<td>Small Group</td>
<td>-.05</td>
<td>.07</td>
<td>-.05</td>
<td>.16*</td>
<td>.01</td>
<td>.14*</td>
</tr>
<tr>
<td>Discussions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readings on</td>
<td>-.21**</td>
<td>.00</td>
<td>.34***</td>
<td>-.13</td>
<td>.31***</td>
<td>-.06</td>
</tr>
<tr>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projects</td>
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<td>-.09</td>
<td>.03</td>
<td>.18*</td>
<td>-.02</td>
<td>.15*</td>
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<tr>
<td>Term Papers</td>
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<td>.09</td>
<td>-.03</td>
<td>-.13</td>
<td>-.07</td>
<td>-.10</td>
</tr>
<tr>
<td>Exercises &amp;</td>
<td>.13</td>
<td>-.05</td>
<td>-.15*</td>
<td>.10</td>
<td>-.12</td>
<td>.06</td>
</tr>
<tr>
<td>Simulations</td>
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<td></td>
</tr>
<tr>
<td>Faculty</td>
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<td>.00</td>
<td>-.06</td>
<td>.09</td>
<td>-.02</td>
<td>.02</td>
</tr>
<tr>
<td>Feedback</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>.13</td>
<td>-.08</td>
<td>-.11</td>
<td>.20**</td>
<td>-.14*</td>
<td>.13</td>
</tr>
<tr>
<td>Feedback</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summaries</td>
<td>.03</td>
<td>.07</td>
<td>-.06</td>
<td>-.03</td>
<td>-.06</td>
<td>-.05</td>
</tr>
<tr>
<td>Thinking</td>
<td>.00</td>
<td>.04</td>
<td>.17*</td>
<td>-.07</td>
<td>.08</td>
<td>-.08</td>
</tr>
<tr>
<td>Alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations</td>
<td>.05</td>
<td>.10</td>
<td>-.11</td>
<td>.02</td>
<td>-.10</td>
<td>-.07</td>
</tr>
<tr>
<td>Ind. Faculty</td>
<td>.00</td>
<td>.05</td>
<td>-.11</td>
<td>-.03</td>
<td>-.06</td>
<td>-.07</td>
</tr>
<tr>
<td>Conferences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talks by</td>
<td>.06</td>
<td>.03</td>
<td>-.15*</td>
<td>.02</td>
<td>-.15*</td>
<td>-.01</td>
</tr>
<tr>
<td>Experts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework</td>
<td>.10</td>
<td>.01</td>
<td>-.08</td>
<td>.19*</td>
<td>-.12</td>
<td>.11</td>
</tr>
</tbody>
</table>

* p < .05
** p < .01
*** p < .001 2 tailed test
that the latter is more the case. That is, there appears to be sufficient
evidence from multiple sources to support the validity of the LSI, but
what is needed is a more meaningful model of the learning environment
(e.g. a different kind of list for Table 10) in order to ultimately inves-
tigate matches between learning styles and learning environments. This
possibility will be examined in the next chapter.

LSI Responses and Scoring

As discussed earlier, the LSI consists of four scales, Concrete
Experience (CE), Abstract Conceptualization (AC), Reflective Observation
(RO), and Active Experimentation (AE). Each of these scales is repre-
sented by a column of adjectives on the LSI. There are nine rows of the
four columns and a subject is asked to read across the columns, row by
row, and indicate the adjective that most describes his style with a
"4," next most with a "3," and so on. By totaling the sum of responses
in each column (CE, AC, etc.) a score for each scale is obtained. In the
revised LSI used in this study, certain items in each column are "dummy"
items and are not totaled when scoring the column. In the example LSI
below, the items to be scored in each column are starred, and the score
for each column indicated.

To determine the two major dimensions of learning style, the concrete
score is subtracted from the abstract score (AC - CE), and the reflective
score is subtracted from the active score (AE - RO). This yields the
subject's preferred orientation on each of the two learning style dimen-
sions, concrete-abstract, and reflective-active. As is evident in the
sample LSI, following, the scores on the individual scales (CE, AC, RO,
Learning Style Inventory Example

1. 1_discriminating  2_tentative*  3_involved  4_practical*
2. 4_receptive*  3_relevant  2_analytical*  1_impartial
3. 2_feeling*  3_watching*  1_thinking*  4_doing*
4. 2_accepting*  4_risk-taker*  1_evaluative*  3_aware
5. 4_intuitive*  1_productive  2_logical*  3_questioning
6. 3_abstract  1_observing*  4_concrete  2_active*
7. 2_present-oriented*  3_reflecting*  1_future-oriented  4_pragmatic*
8. 4_experience*  2_observation  3_conceptualization*  1_experimentation*
9. 3_intense  2_reserved*  1_rational*  4_responsible*

CE = 18  
RO = 13  
AC = 10  
AE = 19

AC - CE = -8  
AE - RO = 6

AE) can range between 6 and 24 since there are six scored items in each column, each receiving a 4, 3, 2, or 1. A score of 24 indicates a highly preferred scale for the subject while a 6 indicates low preference. Thus, in subtracting one scale from another, a negative total would indicate a preference for either CE or RO. For example, in the sample LSI above, the AE - RO score of 6 indicates an Active Experimentation preference.

The combined scores, AE - RO and AC - CE, make it possible to graphically represent a sample of individual styles. Values for AC - CE range from +18 (abstract) to -18 (concrete). Values for AE - RO range from +18 (active) to -18 (reflective). To display LSI scores consistent with previous research and with normal two-dimensional graphics,
the AC - CE and AE - RO scores from students in this study were multiplied by -1 in order to be plotted on a graph like the one below. (Note that the score from the example LSI, x = 6, y = -8 is plotted as x = -6, v = 8).

Concrete

+18

example score
(-6, 8)

Active -18

0

+18 Reflective

-18

Abstract

LSI Results

Of the forty graduate landscape architects returning questionnaires (see Appendix 8) thirty-nine returned usable LSI scores. The summary scores (AC - CE and AE - RO) were obtained for each and plotted according to the previous example. The resulting scattergram of this sample is shown in Figure 8.
Figure 8.

Distribution of LSI Scores for Landscape Architecture Students (N=39).

KEY:
○ - First year student
● - Second yr. student
+ - Third yr. student
As expected when this site was selected, there is a large degree of variance in learning styles amongst the respondents. First and second year students, in particular, score in each of Kolb's four quadrants or learning styles. It is interesting to note that the third year respondents, though small in number, appear to be more similar to one another and more Convergent, in Kolb's terms, as a group than either of the other student groups. This may reflect a socialization process whereby the overall environment of the department begins to influence the learners, who were at one time very diverse in learning style, to create a group with a particular style that is compatible with the demands, attitudes, and norms of the profession. The third year student in this program is either finishing a three-year master's degree program or is the holder of an undergraduate degree in some area of design/architecture and is in the last phase of an advanced degree which has taken two years to obtain. This latter type enters the program at the second-year level.

Kolb's four learning styles (i.e. Converger, Diverger, etc.) are determined by dividing scattergrams like that in Figure 8 into four quadrants. Since Kolb has consistently found an abstract bias in his LSI test results, he uses large population means to determine these quadrants rather than absolute zero on the grid used to plot them. His largest sample consists of managers and advanced management students (N = 741) whose mean AC - CE (or y-axis) score was -4.15 and whose mean AE - RO (or x-axis) score was -3.23. For this sample of landscape architecture students, the mean AC - CE score was -2.60 and the mean AE - RO score was -3.06. Thus, compared to the management population, this group tends to score as more active and less abstract in their learning styles.
These mean scores and the axes they represent are shown in Figure 9. Since there are no previous studies of these types of students using the LSI, it was decided to differentiate the respondent sample according to its mean scores on the two dimensions. This would enable one to then "type" students in Kolb's terms according to which quadrant they fell in, or in this case, to divide them into four subsamples for further analysis. These samples and the axes for division are shown in Figure 9. In order to examine correlation with the environmental model and LED tool in the previous chapter, the rotated axes split learners into 'pure' groups: highly concrete learners, "Hi CE's;" highly reflective learners, "Hi RO's;" highly abstract learners, "Hi AC's;" and highly active learners, "Hi AE's."

A few respondents who scored around the 0,0 point of the adjusted axes (see shaded area in Figure 9) were arbitrarily discarded from this analysis because they did not represent any particularly dominant or preferred learning style.

Summary

Kolb's Learning Style Inventory was used to measure differences in individual learning styles among the sample of graduate landscape architects. As hoped for in selecting this sample for study, the population varied satisfactorily on the two dimensions used to "type" one's style: the abstract versus concrete dimension (AC - CE score) and the active versus reflective dimension (AE - RO score). Since the sample population means on these dimensions were less abstract and more active than Kolb's larger, management-oriented sample, the sample means for these architect students were used to define axes for categorizing the population into
Figure 9.

Creation of Learner Samples
With Distinct Learning Styles.

-128-
four quadrants or types of learners for future analyses.

With the learner population subdivided into four different types, the validity of the environmental model and LED tool being developed here can be further examined by testing for relationships between a specific part of an environment (e.g. its affective characteristics) and a type of learner who should prefer or do well in that kind of situation (e.g. a high concrete learner). The next chapters will focus on this kind of analysis.
CHAPTER V

Learning Environments and Individual Learning Styles

The purpose of this chapter is to examine whatever relationships may exist between the environmental variables in the model under study and different learning styles. Chapter III has already presented the results of using twenty-one indicators of learning environments, derived from the model being developed, to objectively rate courses. The results matched well with ratings by learners, using the same kind of indicators, suggesting that the model does conceptualize learning environments in ways that learners can also perceive them. In addition to this goal, however, the model of environments being developed is also intended to help in understanding which parts or aspects of a situation are relating or interacting more meaningfully with one learner than another. The four basic constructs or environmental orientations are thought to be indicative of different types of settings that should be perceived as more useful or beneficial by some learning styles versus others. The analyses that follow should help to better understand what aspects of the environment these constructs are picking up and if their variables are measuring consistent or interconnected phenomena.

Environmental Variables and LSI Scores

Each of Kolb's four learning style traits, or areas in which different skills are developed in learners to varying degrees, was hypothesized to relate to a particular environmental orientation as shown on the following page:
<table>
<thead>
<tr>
<th>Type of Environment</th>
<th>Type of Learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective</td>
<td>Concrete Experiencer</td>
</tr>
<tr>
<td>Perceptual</td>
<td>Reflective Observer</td>
</tr>
<tr>
<td>Symbolic</td>
<td>Abstract Conceptualizer</td>
</tr>
<tr>
<td>Behavioral</td>
<td>Active Experimenter</td>
</tr>
</tbody>
</table>

The rank order correlations between LSI scale scores and student ratings of the usefulness of the twenty-one environmental variables used in the LED are shown in Table 11. The environmental variables have been listed under the construct or type of environmental orientation they are hypothesized to measure. Areas of expected relationships are indicated by the boxes in the table. While many relationships appear in expected areas, some appear in unexpected areas and the predicted clustering or grouping of significant relationships does not result.

Of the five Affective indicators, only V18, the indicator of potential for feedback, relates with high scores on Kolb's Concrete Experience (CE) scale. The other four variables correlate positively with CE but not of satisfactory magnitude. All the affective indicators do relate negatively with Kolb's Abstract Conceptualization (AC) scale and with the combined AC - CE scale score. While not necessarily predicted, these results make sense in that AC and CE are opposite learning styles and thus one could expect abstract learners to prefer least what concrete learners prefer most, and vice-versa. What is not clear is whether the Affective cluster is measuring a situation that concrete learners prefer or that abstract learners dislike. These results would tend to support the latter.
Table 11. Correlations Between Learning Style Scores and Student Ratings of Situations That Facilitate Their Learning (N = 39).

<table>
<thead>
<tr>
<th>Environmental Measure from LED</th>
<th>LSI Scales Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CE</td>
</tr>
<tr>
<td>Affective Orientation:</td>
<td></td>
</tr>
<tr>
<td>V3 Purpose to experience</td>
<td>.19</td>
</tr>
<tr>
<td>V5 Info. is &quot;here &amp; now&quot;</td>
<td>.19</td>
</tr>
<tr>
<td>V12 Learners share feelings</td>
<td>.20</td>
</tr>
<tr>
<td>V16 Teacher is model</td>
<td>.10</td>
</tr>
<tr>
<td>V18 Feedback is personal</td>
<td>.45***</td>
</tr>
<tr>
<td>Perceptual Orientation:</td>
<td></td>
</tr>
<tr>
<td>V1 Purpose to understand</td>
<td>-.10</td>
</tr>
<tr>
<td>V7 Focus on &quot;why&quot; or &quot;how&quot;</td>
<td>-.10</td>
</tr>
<tr>
<td>V10 Learners use mult. persp.</td>
<td>-.07</td>
</tr>
<tr>
<td>V13 Teacher is non-direct</td>
<td>0</td>
</tr>
<tr>
<td>V19 Determine own criterion</td>
<td>-.05</td>
</tr>
<tr>
<td>Symbolic Orientation:</td>
<td></td>
</tr>
<tr>
<td>V2 Purpose to solve prob.</td>
<td>-.09</td>
</tr>
<tr>
<td>V6 Info. is abstract</td>
<td>0</td>
</tr>
<tr>
<td>V9 Governed by rules, etc.</td>
<td>.04</td>
</tr>
<tr>
<td>V15 Teacher is taskmaster</td>
<td>-.08</td>
</tr>
<tr>
<td>V17 Teacher is expert</td>
<td>.14</td>
</tr>
<tr>
<td>V20 Learner is right/wrong</td>
<td>.17</td>
</tr>
<tr>
<td>Behavioral Orientation:</td>
<td></td>
</tr>
<tr>
<td>V4 Purpose to apply skill</td>
<td>.24*</td>
</tr>
<tr>
<td>V8 Info. focus on task</td>
<td>-.03</td>
</tr>
<tr>
<td>V11 Self-direct behavior</td>
<td>.37**</td>
</tr>
<tr>
<td>V14 Teacher is coach</td>
<td>.36**</td>
</tr>
<tr>
<td>V21 External criteria</td>
<td>0</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001 (one tail test)

(Boxes denote areas of expected relationships)
The symbolic cluster of variables failed to relate to AC scores in any instance and were slightly negatively correlated in three cases. The "teacher as taskmaster role" (V15) and "learner evaluated right or wrong" (V20) did relate negatively with Kolb's Active Experimentation scale, indicating that these characteristics are not viewed as useful by AE learners. This makes sense in terms of the description of the Behavioral orientation which is expected to relate well to AE learners. V15 and V20 imply restraints that would conflict with the autotelic, self-governed, trial-and-error nature of that type of setting. Another symbolic indicator that related with a learning style was V17, "teacher as expert authority," which related to Kolb's Reflective Observation (RO scale). This may indicate something that the Perceptual orientation cluster should be picking up, but is not: the need for expert or final resolution at some point in the process of examining causes and relationship among events or concepts.

The Perceptual cluster, like the Symbolic, failed to relate as expected to RO scores. Only one variable in this set related at all to any LSI score. V19, "learner determines own criterion," related slightly to Kolb's Active Experimentation (AE) scale. This result, along with the results with V17, may suggest that determining one's own criteria for evaluation is an indicator of Behavioral settings rather than Perceptual, where there may, instead, be a need by learners to have some expert source of definitive opinion versus having to evolve their own.*

Finally the Behavioral cluster of variables related somewhat as

*These kinds of suggestions or implications for revisions in the theory or constructs will be examined in detail in the summary chapter.
predicted with the AE learners. Both V4 and V8, "applying skills to practical problem" and "dealing with information necessary to accomplish a task," related well to AE scale scores and the combined AE - RO score. V11 and V14, however, did not relate to AE scores, but rather to CE scores. Both "self-governed behavior" and "teacher is a coach/helper" fit somewhat with the description of affective environments, but their non-relationship to behavioral environments is puzzling. V21, "external criteria for relevance," related with RO scores instead of AE scores. This fits with the above results noted for V19 and V17. If Behavioral environments are to relate to Kolb's AE scale, then the cluster should include "self-determined criteria" for evaluation instead of "externally based criteria." The latter might be better a characteristic of Perceptual environments where experts are preferred for both definitive opinions and criteria for evaluation.

While one would have hoped for more evidence of general relationships between clusters of variables and LSI scales, the lack of systematic relationships may be due to the LSI instrument and to sampling. The LSI may not be measuring any consistent "trait" in any particular scale. Learners with high CE scores, for instance, may or may not be "the same." All that can be said is that on a forced choice, they rated similar words as most descriptive of themselves. Thus, before concluding anything regarding changing constructs or variables in the model, the learner sample will be divided, as discussed in Chapter IV, in order to look for consistency among "archetypes" of Kolb's learning styles and their preferences for different types of learning environments. This analysis would also test for relationships between select, high scorers on a learning style
scale and environmental variables. A small correlation in Table 11 may be due to random patterns at the low to middle range of scale scores, thus covering up a relationship at the high end.

Comparisons Between Different Learners' Perceptions as to the General Effect of the LED's Environmental Measures Upon Their Ability to Learn

Each of the twenty-one scales in the LED were adapted into questions on the student questionnaire (see Appendix B). Respondents reported the degree to which each particular environmental measure or scale contributed to their general ability to learn. Answers were according to the following scale:

0: actually hinders my ability to learn
1: no help to my ability to learn
2: of little help to my ability to learn
3: helpful to my ability to learn
4: quite helpful to my ability to learn
5: extremely helpful to my ability to learn

The results are discussed below for each category of environmental indicator, as used in constructing the LED tool (see Chapter III).

A. Main purpose of activity indicators;

The mean responses of the four different groups of learners in the respondent sample to the LED measures having to do with the objectives or purpose of the learning environment are shown in Table 12. All four measures in this category were rated as "helpful" or better (\( \bar{x} \geq 3.0 \)) by all types of learners. As predicted reflective learners rated "understanding" highest, and active learners rated "application" highest.
Table 12. Mean Scores on Extent to Which Major Purpose of Learning Activities Helps Learning Ability, By Different Learner Types.*

<table>
<thead>
<tr>
<th>INTENDED PURPOSE OF ACTIVITIES</th>
<th>MEAN RESPONSE BY LEARNER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HI Concrete (N=7)</td>
</tr>
<tr>
<td>1. To understand a concept</td>
<td>3.86</td>
</tr>
<tr>
<td>2. To solve a problem</td>
<td>4.12</td>
</tr>
<tr>
<td>3. To experience a professional situation</td>
<td>4.14</td>
</tr>
<tr>
<td>4. To apply knowledge, skills to a relevant problem</td>
<td>5.0</td>
</tr>
</tbody>
</table>

* Underline denotes score predicted to be highest for that environmental variable.

The concrete learners rated "experiencing" higher than any other group, as would be expected, but also rated "application" higher than any other group. It may be that due to the nature of landscape architecture, it is the application of knowledge and skills to a real-life problem that enables one to become aware of his feelings, attitudes and values regarding the profession itself, and so "application" and "experiencing" are not easily separable by those concrete learners who value being in touch with their feelings during a learning experience. The notion of having the "solution to a problem" as a goal did not appear most useful to the abstract learners, contrary to what the model would have predicted. It may be that the connotation of the term "problem" is also highly influenced by the field and that in landscape architecture, there are little if any problems that lend themselves to right versus wrong solutions or to the deductive, puzzle-solving rigor that Kuhn associates with scientific or
"abstract" endeavors. Thus the high rating given by the concrete learners to "solving a problem" may be because in this field, taking an action step, making a decision, etc. is seen as solving something. In general, this set of measures does seem to draw out environmental differences in terms of helping the learner to conceptually process and connect information so as to be able to explain something (understanding) versus helping the learner to realize and express his opinions, feelings, values concerning an issue while he is actually engaged in trying to work through a problem that he would face as a professional (experiencing and applying).

B. Source of information indicators:

The extent to which the nature of the principal source of information being dealt with in a learning environment is seen as helpful to different types of learners is depicted in Table 13. As predicted, information resulting from sharing and discussing personal feelings, reaction, ideas, etc. was rated highest by the concrete learners. Discussing how or why things should be, or relate to one another, was rated highest by the reflective learners, as predicted, and active learners rated highest the generation or handling of information that directly effects doing some task, also as the model would predict. Characterizing the source or focus of information as "abstract," however, did not appear to usefully differentiate any learner group. While the abstract group (Hi AC's) rated this measure highest compared to the other types of learners, they rated it lowest of the four environmental indicators in overall usefulness to them. One possible explanation could, again, have to do with the nature of the field itself. It may be that any information that does not come from
Table 13. Mean Scores on Extent to Which Nature of Information Dealt With in Learning Environment Helps Learning Ability, by Different Learner Types.

<table>
<thead>
<tr>
<th>Nature of Principle Information Being Dealt With</th>
<th>Mean Response by Learner Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H1 Concrete (N=7)</td>
<td>H1 Reflective (N=8)</td>
</tr>
<tr>
<td>5. Here and now (ideas, opinions, feelings, etc.)</td>
<td>4.86</td>
<td>4.0</td>
</tr>
<tr>
<td>6. Abstract (data, readings, statistics, recollections)</td>
<td>3.29</td>
<td>3.25</td>
</tr>
<tr>
<td>7. Focused on how or why (relation between events, discussion of process)</td>
<td>3.0</td>
<td>4.25</td>
</tr>
<tr>
<td>8. Focused on doing a task (action planning, discussing next steps, timing, presenting)</td>
<td>4.0</td>
<td>3.13</td>
</tr>
</tbody>
</table>

*Underline denotes score predicted to be highest for that environmental variable.

either a respected role model verbally or from peers during the actual process of working on a real problem is viewed as not relevant to the highly personalized, creative, immediate nature of landscape architecture. So even if one would predict that abstract learners do best with "there and then" information from readings, reports, etc., they may see it as too detached from the immediate nature of design work to be meaningful. It is also interesting to note in Table 13 those environmental measures that differentiated some learners on the low or "less helpful" end of the response scale. Information focused on "how or why" things relate, for example, was rated relatively low by concrete learners. This suggests that this dimension may be differentiating patient, explorative learners (reflective group) from trial-and-error, impulsive learners (concrete
group) who might not sit still for an open-ended discussion of basic approaches to a site-planning problem or to brainstorm all the different ways by which a certain land configuration might be graphically displayed. Similarly, the reflective group, as would be expected, rated the task-related information dimension the lowest of the four groups. This dimension may also be differentiating a basic difference in learners between "getting it done" and "knowing why or how to do it." The reflective group might be very frustrated at constantly working towards a task goal, unless that goal was to discuss various approaches, reasonings, etc. Finally, the abstract learners rated the "here-and-now" source of information lowest of the four groups. This also fits with the model in the sense that this dimension is probably detecting how comfortable people are with both disclosing and listening to personal feelings about the topic or task at hand.

C. Rules guiding learner behavior indicators:

Table 14 summarizes the perceived effect of rules guiding student behavior on each of the four types of learners. The general absence of rules for learners, or the fact that they are left to manage themselves and that what they do at a point in time depends on what they just did prior to that time, strongly differentiates the active, experimental, and concrete learners from the reflective, abstract learners. As predicted, the active learners rate this dimension highest of the four groups. Situations and discussions encouraging learners to share their personal feelings and opinions appears to separate abstract learners from all the rest. This dimension seems to appeal to active, concrete, and
### Table 14. Mean Scores on Extent to Which Rules Governing Student Behavior Help Learning Ability, By Different Learner Types.*

<table>
<thead>
<tr>
<th>RULES GUIDING STUDENT BEHAVIOR</th>
<th>MEAN RESPONSE BY LEARNER TYPE</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hi Concrete (N=7)</td>
<td>Hi Reflective (N=8)</td>
<td>Hi Abstract (N=12)</td>
<td>Hi Active (N=7)</td>
</tr>
<tr>
<td>9. Dialogue governed by rules of inference, jargon, need to memorize, etc.</td>
<td>3.14</td>
<td>2.5</td>
<td>3.17</td>
<td>3.28</td>
</tr>
<tr>
<td>10. Learner encouraged to take on multiple perspectives</td>
<td>3.0</td>
<td>3.25</td>
<td>3.67</td>
<td>2.86</td>
</tr>
<tr>
<td>11. No rules: learners govern own time and activities</td>
<td>4.0</td>
<td>3.5</td>
<td>2.67</td>
<td>4.14</td>
</tr>
<tr>
<td>12. Learners encouraged to share feelings, opinions, etc.</td>
<td>4.29</td>
<td>4.38</td>
<td>3.34</td>
<td>4.28</td>
</tr>
</tbody>
</table>

*Underline denotes score predicted to be highest for the environmental variable.

Reflective learners and is probably detecting a desire or value some learners place on peer interactions, since the expression of values, ideas, etc. is probably going to occur in some planned peer group activity. Abstract learners, therefore, may be indicating here a preference for individual activities where there is not pressure or suggestion to give or receive feedback or ideas from peers. Rules forcing the learner to observe or consider a topic or phenomenon from different perspectives did slightly differentiate reflective and abstract learners from concrete and active ones, however it was the abstract learners who rated it highest, not the reflective learners as expected. It does appear that this environmental indicator is separating out those who wish to think things through on their own (Hi RO's and Hi AC's) and those who wish to push on
to see what results will occur (Hi AE's and Hi CE's). Rules of inference, terminology and other things that constrain and guide dialogue in a learning situation were not viewed as particularly helpful by any group. Contrary to predictions, it was rated highest by the active learners instead of the abstract learners. It may be that having to memorize terms and use accepted jargon and symbolization in presentations helps make these applied learners feel like the problem they are working on is real in the sense that they are trying to do exactly as a professional would do in that instance.

D. Teacher role indicators:

The perceived impact of teacher roles as an environmental characteristic on different types of learners is shown in Table 15. These data indicate that only two of the five roles described were preferred generally (\( \bar{x} \geq 3.0 \)) by the total respondant sample. The coaching/helping and leader-by-example functions teachers can fulfill were rated highly by all groups of learners. The active and concrete learners rated "leaders-by-example" or models of the profession highest, as predicted, although the variance across the four groups for this measure was small. Concrete and reflective learners rated coaching or helping teachers higher than did the abstract and active learners, contrary to the prediction that this kind of teacher would appeal to the active and concrete learners. The active-abstract versus concrete-reflective split here may suggest that this measure of teacher role is tapping the degree to which learners prefer to be alone during a major activity versus working with others, be they faculty or peers. Teachers as taskmasters, experts, or non-directive probers were rated relatively low by all learners, the total sample
Table 15. Mean Scores on Extent to Which Teacher Roles Help Learning Ability, by Different Learner Types.*

<table>
<thead>
<tr>
<th>INTENDED TEACHER ROLES</th>
<th>MEAN RESPONSE BY LEARNER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HI Concrete (N=7)</td>
</tr>
<tr>
<td>13. Teacher is non-directive, intuitive, answers a question with a question</td>
<td>2.29</td>
</tr>
<tr>
<td>14. Teacher is coach, helper at learners' request</td>
<td>4.57</td>
</tr>
<tr>
<td>15. Teacher is taskmaster, enforcer of time, organizer</td>
<td>2.14</td>
</tr>
<tr>
<td>16. Teacher is leader-by-example, role model</td>
<td>4.0</td>
</tr>
<tr>
<td>17. Teacher is expert, interprets body of knowledge</td>
<td>2.57</td>
</tr>
</tbody>
</table>

*Underline denotes score predicted to be highest for that environmental variable.

mean being less than 3.0 or in the "of little help" to "helpful" range.

Abstract and reflective learners did value all of these three teacher roles more than did the active and concrete learners. Although these results fit somewhat with those predicted by the environmental model (see Figure 5, Chapter II), the generally low mean scores were not expected. It appears as if non-directiveness is not seen as helpful, possibly due to the fact that the field of design is so nebulous or undefined in the first place. Hence, even though we would expect reflective and abstract learners to value spending time discussing definitions, philosophies, theories, etc. related to landscape architecture, they would see as helpful a more direct, opinionated teacher to guide them along versus a
non-direct, probing teacher. (This was also indicated in the correlation results in Table 11.) It looks as if, given the personalized nature of design work, what the learners see as helpful is a teacher who is being personal, himself. Competence may not be appreciated in terms of how much knowledge or information the teacher can bring to bear on a problem, but rather in terms of his ability to relate his experience as a professional to the learner to help him with a particular problem.

E. Potential for feedback indicators:

The perceived impact of potential for feedback and evaluation on learners' ability to learn is shown in Table 16. All learners appear to value personalized feedback that is related to their own goals. The abstract group values this the least, possibly because personalized feedback may appear too subjective, irrational, or not conceptually pure. On the other hand, none of the learners rated being judged as right or wrong as being very helpful. This may be due to the obvious fact that there are few right or wrong solutions to design problems. Rather, it is probably understood by most of these students that their efforts are more likely to be assessed according to criteria of relevance, usefulness, sellability, etc., which they all rated highly, with the active learners seeing this as most helpful, as predicted. Finally, being left to determine one's own criteria of relevance was rated higher by the abstract and active groups. This may be due, again, to their desire to work alone or to be less dependent upon others for evaluation or help, as was discussed earlier with respect to teachers being coaches or helpers. Contrary to the model's prediction, reflective learners did not prefer this very much,
Table 16. Mean Scores on Extent to Which Potential for Feedback and Evaluation Help Learning Ability, By Different Learner Types.*

<table>
<thead>
<tr>
<th>Potential for Feedback or Evaluation</th>
<th>Mean Response by Learner Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HI Concrete (N=7)</td>
</tr>
<tr>
<td>18. Feedback is personalized and based on individual learner's goals</td>
<td>4.14</td>
</tr>
<tr>
<td>19. Learner left to determine own criteria of relevance</td>
<td>2.86</td>
</tr>
<tr>
<td>20. Learner is judged as right or wrong</td>
<td>1.57</td>
</tr>
<tr>
<td>21. Learner performance is weighed against external criteria of relevance</td>
<td>3.71</td>
</tr>
</tbody>
</table>

*Underline denotes score predicted to be highest for that environmental variable.

nor did concrete learners, who prefer personalized feedback from some external source like a teacher serving as a professional role model.

Of the twenty-one environmental indicators, eleven were rated most helpful to their ability to learn by the predicted type of learner. In terms of the categories of environmental indicators used to describe learning environments, Nature of Information Being Dealt With appears most valid by this analysis. All four indicators in this category related to the predicted learner type. The Intended Purpose of Activity category related to concrete, reflective and active learners as predicted, but not to abstract learners. Rules Governing Student Behavior generally differentiated reflective and abstract learners from concrete and active learners but not as specifically (i.e. differentiating four ways) as expected.
Three of five indicators of Teacher Role related to learner type as predicted, but only two of five were rated by the entire sample as being at least "helpful" to their ability to learn. And only one of four indicators of Potential for Feedback related to a type of learner as expected. Here, as in the Teacher Role category, there appeared to be general or overriding relationships across the total sample (i.e. being judged as "right or wrong" wasn't valued by anyone). In many instances, the environmental variable seems to overlap between two types of learners.

VII for instance (Mo Rules: Learner Governs Own Time and Activities) is rated more helpful to Hi AE's (as predicted) and Hi CE's versus the others. What may be occurring is that some of the measures are corresponding more to Kolb's style definition (in this instance the Accommodator who is high in CE and AE) than to the absolute LSI scale scores which have been used to subdivide the respondents into four distinct learner groups. It also appears that in several cases, the actual indicator needs rewording or more specificity in order to be useful as a differentiator. These will be considered more fully after further analysis.

Finally, with respect to the four types of environmental orientation, the above analyses indicate support for the Affective cluster of variables where three of the five indicators were rated highest by the Hi CE group and the Behavioral cluster of variables where four of five variables were rated highest by the Hi AE group. Only two of six Symbolic indicators were rated as expected by the Hi AC group and only two of five Perceptual indicators were rated as expected by the Hi RO group.
Intercorrelation Analyses of Environmental Constructs by Select Learner Samples

In the previous chapter, Kendall's Coefficient of Concordance was used to assess the degree of underlying connectedness among the variables measuring each of the four types of environmental orientation. Intercorrelation matrices from the total sample of landscape architecture students were constructed in order to compute a value for Kendall's W. One would expect that given a specified subsample (versus the total population) whose learning style is predicted to relate to a specific type of environment, the resulting correlation matrix would result in a greater W or in a greater degree of internal consistency among the variables. An increase in W for the Affective cluster would indicate, for example, that the judges in the selected sample (e.g. Hi Concrete learners) were applying more consistent criteria in rating the variables in the Affective factor than did the total sample; that they perceived the five variables making up the affective factor as more related to one another than did the total sample of learners. Table 17 shows the Kendall coefficients of concordance for each of the four environmental types, first for the total sample (N = 40) which was derived in the previous chapter, and then for the selected sample hypothesized to relate to that type of environment (W derived in same manner as detailed on page 105 ). The expected result occurred for the Perceptual and Behavioral factors. The W's increased substantially and were statistically significant. This suggests that the variables making up these two constructs were perceived as more interrelated or conceptually connected by learners who score highest on the LSI RO and AE scales, respectively, than by the total
Table 17. Kendall Coefficient of Concordance for Environmental Constructs, by Total and Selected Sampling.

<table>
<thead>
<tr>
<th>Type of Environmental Orientation</th>
<th>Kendall Coefficient of Concordance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Sample (N=40)</td>
</tr>
<tr>
<td>Affective</td>
<td>$W = .303^*$</td>
</tr>
<tr>
<td>Perceptual</td>
<td>$W = .271^*$</td>
</tr>
<tr>
<td>Symbolic</td>
<td>$W = .181$</td>
</tr>
<tr>
<td>Behavioral</td>
<td>$W = .152$</td>
</tr>
<tr>
<td></td>
<td>Selected Sample</td>
</tr>
<tr>
<td>Affective</td>
<td>$W = .013$ (Hi CE's, N=7)</td>
</tr>
<tr>
<td>Perceptual</td>
<td>$W = .454^{**}$ (Hi RO's, N=7)</td>
</tr>
<tr>
<td>Symbolic</td>
<td>$W = .131$ (Hi AC's, N=12)</td>
</tr>
<tr>
<td>Behavioral</td>
<td>$W = .465^{**}$ (Hi AE's, N=8)</td>
</tr>
</tbody>
</table>

* $p < .05$, one tail test  
** $p < .01$, one tail test

population of mixed styles. The Symbolic factor remained nonsignificant. The most puzzling result was the sharp decrease in the value and the significance of $W$ for the Affective factor. In view of the apparent validity of this factor from the previous analysis of mean ratings of environmental variables by learner type, this result may be due to the lack of enough variance among the responses from this group to create meaningful correlations.

To create more variance, larger samples were created to use with the Affective variables. The total learner sample was divided into "more concrete than abstract" and "more abstract than concrete" groups based on their AC – CE scale scores. Table 18 shows the resulting mean responses by these groups to the usefulness of the five indicators of Affective environments.
Table 18. Mean Scores on Extent to Which Indicators of Affective Orientation Help Learning Ability, by Learner Type.

<table>
<thead>
<tr>
<th>Environmental Indicator</th>
<th>Type of Learner</th>
<th></th>
<th></th>
<th>t-Test (one-tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>More Concrete (N=18)</td>
<td>More Abstract (N=21)</td>
<td></td>
</tr>
<tr>
<td>V3 - Focus on experiencing</td>
<td>3.72</td>
<td>3.05</td>
<td></td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>V5 - Info. is &quot;here &amp; now&quot;</td>
<td>4.22</td>
<td>3.67</td>
<td></td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>V12 - Express feelings</td>
<td>4.28</td>
<td>3.71</td>
<td></td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>V15 - Teacher is role model</td>
<td>2.40</td>
<td>2.61</td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td>V18 - Feedback is personal</td>
<td>4.56</td>
<td>3.95</td>
<td></td>
<td>p &lt; .01</td>
</tr>
</tbody>
</table>

The results indicate that the Affective cluster, with the exception of the teacher role indicator, is strongly differentiating the "concrete" aspects of the environment from the "abstract." That is, the Affective construct is differentiating (i.e. is seen as more useful to) learners seeing themselves as 'receptive,' 'feeling,' 'accepting,' 'intuitive,' 'present-oriented,' and 'experiencers' from those who see themselves as predominantly 'analytical,' 'thinkers,' 'logical,' 'rational,' and 'conceptualizers.' The fact that the teacher role variable, V15, does not significantly differentiate this sample has been noted and discussed in the preceding analyses. The strength of the overall results in Table 18 would support the notion that the decrease in W for the Affective construct in Table 17 is primarily due to the small sample size and low variance among that select group, not because the variables making up the Affective construct are viewed as unrelated conceptually by the Hi Concrete Learner group.
Discussion

Given the preceding results, we are now in a position to begin to assess the overall validity of the four environmental orientations making up the model under study.

A. The Affective Orientation:

V3 - Focus of activity is on experiencing professional situation
V5 - Source of information is "here and now"
V12 - Learner encouraged to express personal feelings, opinions, etc.
V15 - Teacher is model of profession, doer by example
V18 - Feedback is personal, based on individual needs

For the total population, only V18 correlated with the CE scale score on Kolb's LSI as predicted. All of these variables did correlate negatively with the AC scale, however, For the Hi Concrete learner group, V3, V5 and V16 were rated more helpful than by any other type of learner. V12 and V18 were rated highly but even higher by the Hi Active learner group. Finally, although these variables were viewed as only moderately internally connected (W = .3) by the Hi Concrete group, the differences in means between larger sample preferences of more concrete versus more abstract learners is significant for all but V15.

These results generally indicate that this construct is differentiating a part of a learning situation that is favored by people who see themselves as feeling, intuitive, present-oriented, receptive, etc. and disfavored by learners who perceive themselves to be analytical, thinking, logical, rational, etc. There is some evidence that conceptually the Affective component being measured by this construct may also be picking
up certain hypothesized aspects of a Behavioral environment. Learners who see themselves as active (practical, doing, pragmatic, experimental, etc.) also favor V12 and V18. This certainly makes sense in this test site where experiencing a professional role (V3), reacting to the present (V5), having to share feelings and opinions (V12) and needing personal feedback (V18) are most experienced in the "doing" of site designs, working at one's desk in the studio, completing a project assignment, etc.; all of which are tasks related to the Behavioral orientation in our model. Although discussions and problem formulation activities (i.e. Perceptual or Symbolic oriented events) could have affective characteristics (as measured by these variables) it is less likely in this setting. Finally, of the five affective indicators, the teacher role, V15, appears in need of rework. The "cues" in the question to the learners (and observer using the LED) were "role model" and "leader-by-example." These may have been too vague and partly why the LED did not score some courses as more affective in their orientation. There seems to be a notion of "personability," "friendliness," or "someone I could work with" that is needed to pick up more of what it appears some learners were getting from the course they rated as highly affective.

B. The Perceptual Orientation:

V1 - Activity focus on understanding concepts/relationships
V7 - Information focus on process or how things relate
V10 - Learners encouraged to take on multiple perspectives
V13 - Teacher is nondirect, intuitive
V19 - Learner determines criteria for evaluation
Unlike the Affective factor, this group of variables gains some credibility when put to the change in degree of concordance test. The increase in W from .27 to .45 when just data from the select sample of Hi Reflective learners is used was as predicted. This indicates that these indicators are seen as a more coherent factor to learners who see themselves as observers, watchers, tentative, etc. This reflective learner group also rated V1 and V7 the highest of all learners, as predicted. V10 did not relate to the highly reflective learners as much as to the highly abstract (Hi AC) group. The issue here may be "new" versus "multiple perspectives" as discussed in the reporting of the observer measures of courses using the LED in Chapter III. In that instance, learners rated an introduction to the computer as highly perceptual while the follow-on course in applying computer techniques to site planning was seen as more symbolic. In the first course, the added perspective (to previously learned ways of analyzing the problem) was new to them and therefore demanded perceptual skills to understand and digest it as one more way to look at a problem. In the second course, the computer was now one more tool or perspective from which to view a problem. The Hi Abstract learners seem to be saying that they value having as many potential perspectives to apply to a problem as possible and thus rated that course highly Symbolic.

V13 and V19 appear to be the weak links in this factor. The teacher role as a nondirect, intuitive type was rated low by all learners. It is impossible to know from this study if this is an evaluation of the faculty who tend to be that way or an objective fact that this type of behavior is less than helpful to any kind of learner. If one looks in Table 15 at
which teacher roles the H1 Reflective group did rate highly, the results suggest that this factor might be altered to include an indicator that touched on some combination of a "helper at learner request" and a "role model by example." This would make sense if one envisioned learning activities where learners had to compare and contrast various conceptual approaches in order to derive their own theory or approach to a problem. If this felt vague or ambiguous to the learner, a nondirect teacher would only confound the situation. If, at the learner's request, a teacher could be specific or answer by example, it may be more helpful to the learner. V19 was also rated generally low by all learners, but particularly low by the H1 Reflective group. Being left to determine one's own criteria for evaluation when one is immersed in vague and abstract concepts might be an overload. Again, looking at what the H1 Reflective group said was most helpful in Table 16, it would suggest that the feedback indicator for this factor be altered to pick upon an "individualized," "learner solicited" and "externally based" process. An example may be a Ph.D. candidate submitting a set of questions from which a faculty advisor picks and/or modifies to create an essay exam to evaluate the candidate's progress.

C. The Behavioral Orientation:

V4 - Activity focus on application of knowledge to practical problem
V8 - Information focused on getting a task done
V11 - Learner responsible for own time - no rules
V14 - Teacher is coach-helper at learner's request
V21 - Performance evaluated against real life constraints
Of the five variables used to measure this type of orientation, three (V8, V11 and V21) were rated highest among all learners by the Hi Active learner group, as predicted. The "lifelike, real task" notion of an environment comes through clearly. The key information is whatever is necessary to get the job done. Evaluation is as it would be in real life, and the learner manages himself, his time, etc. as he would be expected to in real life. V4, to apply knowledge and skills to a practical problem, was also rated highly by the Hi Active group, but not quite as much as to the Hi Concrete learners. As noted earlier, they all gave this indicator the highest possible rating. The overlap is probably due to the "real problem" part. What is real to a concrete learner (Hi CE) could be whatever he or she is doing at that moment. For the active learner, however, it seems to have to do with the degree to which the task emulates his concept of what a real life practitioner in the field would be doing.

The teacher role indicator, V14, is again the weakest of the five. The Hi Active group rated this role relatively well compared to other teacher role indicators, but less well than other types of learners (see Table 15). These active learners, like the concrete learners, appear to prefer the leader-by-example/role model of the profession type teacher to any other kind. Since this overall factor seems to be characterizing the more practical, self-governed, skill practice nature of an environment, it may be that any teacher role, if imposed, would not be preferred. Rather like a real-life colleague, the behaviorally oriented teacher role may be one of friendly support, sometimes solicited and other times not.

Finally, to add meaning to this type of environmental orientation, it is interesting to note an increase in W (.152 to .465) when just data
from the Hi Active group was used. This indicates that for these active-
experimental learners, this factor makes more sense as a conceptually
connected cluster of variables than to the total learner sample. The Hi
AE learners in this example also rated V19 (Learner determines own criteria for evaluation) rather highly. In fact, if this variable were included
in the correlation matrix with V4, V8, V11, V14 and V21, the concordance
coefficient W for the Hi Active group would be .520 (p < .001). This
makes sense in that one would expect to ultimatately decide his or her
own degree of success in this kind of environment. If a student had done
a real life site plan and had others critique it according to typical real
life criteria, the results are typically mixed: not all right not all
wrong. So the learner would be left in this type of environment to con-
clude for himself just how well he did.

D. The Symbolic Orientation:

V2 - Activity focus on getting "solution to problem"

V6 - Source of information is "there and then"

V9 - Acts governed by rules of inference, jargon, etc.

V15 - Teacher is organizer, taskmaster

V17 - Teacher is expert authority

V20 - Performance evaluated against right or "correct" answer

From the analyses so far this construct appears the least valid.

Only the two teacher roles, V15 and V17, were rated highest among learners
by the Hi Abstract group as expected. And even in these instances the
means were at the "slightly helpful" level. These abstract learners rated
"helpers" and "leaders-by-example" more helpful, Although "solving a
problem" (V2) was rated well by the Hi Abstract learners it appears to be too vague. As worded it did not capture the deductive, puzzle-solving aspect intended. V4, to understand concepts, was rated very highly by abstract as well as reflective learners. Perhaps the better indicator of the Symbolic orientation is "to understand concepts via obtaining solutions to problems." This would differ from the Perceptual orientation where understanding could come from merely discussing concepts, listening, etc.

This Symbolic factor, as currently measured, may be getting at multiple aspects of the environment, and thus not showing much internal consistency overall (e.g. negligible W's for total and selected sample). A look at the intercorrelations among these six variables for both total and the select sample indicates mild support for two fairly independent clusters. On the one hand are V9 and V17 which correlate positively with each other ($r_s = .29$, $p < .05$, selected Hi AC sample), but not with V6, V15 and V20, which also correlate well with one another (for both total sample and selected Hi AC sample). On the one hand is an indicator of things being learned with strict adherence to rules, formulæ and processes and dependence upon an "expert authority" to interpret and answer questions. On the other is manipulation of abstract data, organization by the teacher, and getting right versus wrong answers. The former may be overlapping somewhat with the Perceptual domain in that it suggests settings where new or "foreign" terms, notions, or ideas are being learned or practiced for the first time. The latter set of indicators may be more toward the Behavioral domain in that the right versus wrong solution orientation and teacher as organizer suggests problem solving or
application of abstractions to a problem in order to get a resolution.

Finally, the data does suggest negative indicators of Symbolically oriented environments. At least for this sample of Hi Abstract learners, things like "no rules" (V11) and "being judged right or wrong" (V20) and teachers as "nondirect probers" (V13) were rated very low ("not helpful to only slightly helpful"). It may be that Symbolic environments can be detected in terms of the absense of these things which are also indicators of other types of orientation when their presence is considered.

**Summary**

In order to examine the validity of the basic construct underlying the environmental model being developed, the student sample was divided into distinct subsamples based on Kolb's Learning Styles Inventory. Four groups were created, each representing a different learning style. Analyses were then done to see if the different environmental measures correlated with and differentiated one type of learner from another. Three sources of data were considered:

1) Correlations between LSI scores and environmental measures for the entire sample.

2) Mean ratings of each environmental indicator by type/style of learner.

3) Change in coefficient of concordance when correlations are considered from just one type of learner versus the total sample.

While no construct performed as predicted in all the above analyses, there was evidence to support the basic validity of several of the variables in three of the four constructs or types of environmental orientation.
All indicators of the Affective orientation were rated as most helpful by high scorers on either Kolb's Concrete Experience or Active Experimentation scales. This suggests that these variables are picking up that aspect of environments that involves the learner personally, focuses on his feelings and reactions, gives him personal feedback, requires some action or doing on his part, and provides interaction with a teacher who is friendly and exemplifies a model colleague. The variables measuring this orientation (with the exception of the teacher role indicator) also serve to strongly differentiate the preferences of more concrete versus more abstract learners on Kolb's LSI scales. This also indicates that the construct it typifying the above kind of setting, rather than one requiring a lot of impersonal thought manipulation of abstract data and symbols, deduction of solutions or courses of action, etc.

While none of the indicators of the Perceptual orientation correlated with LSI scores for the total sample, this construct was nonetheless viewed as conceptually connected by a select group of highly reflective learners. Their high ratings of three of the indicators suggest that this construct is picking up situations where the purpose is to understand basic conceptual relationships or notions and the primary information stems from trying to find out "how" or "why" things relate. There is also some data to suggest that learning a "new" way of viewing something may be characteristic of this orientation as well.

The Behavioral orientation, like the Affective orientation, was rated most helpful by either highly active learners (for three variables) or highly concrete learners (one variable). This indicates support for the type of situation said to be "behavioral" where there is a task focus, personal involvement in terms of time management and leadership, and a
sense of realism or pragmatism in a problem being solved. With the addition of a "potential for feedback" indicator focusing on the learner setting his own standards/priorities to evaluate his work, this construct attains a strong statistical degree of concordance, as viewed by the highly active learners in Kolb's terms.

Using a select group of highly abstract learners in Kolb's scheme, no results were found to support the validity of a Symbolic orientation to environments as it is presently conceptualized. Rather there were negative indicators of what abstract learners like or perceive as helpful to them. These came mostly from the indicators of the Affective orientation. There were mild intercorrelations among the indicators of the Symbolic construct to suggest that it may be tapping into two different types of situations. One is where the learning of abstract things and solving of problems results from adherence to strict methodology, terms, rules, etc. and dependence upon an expert authority to interpret the field or answer questions. The other typifies more a process wherein the data used to make decisions is abstract, there is an ordering of events by an instructor and a solution is sought that is correct or incorrect.

The results also suggest some areas of overlap or interconnectedness among the four constructs or environmental orientations. The Affective and Behavioral orientations are both rated most helpful by learners who score highest on the LSI's active experimentation and concrete experience scales. The notions of personalized feedback, experiencing a situation, and solving a pragmatic, real-life problem typify situations both types of learners rate as very helpful. And as was mentioned for the Symbolic indicators, there is some data to suggest that some of the variables are
rated highly by reflective learners and could fit well with the Perceptual orientation (i.e. learn concepts via strict method, rules and expert authority) and others by the active learners, suggesting an overlap with the Behavioral orientation (i.e. solving problems using concepts with process guidance from instructor).

In sum, there is at least partial support for the notions underlying the environmental model being developed. Some evidence exists to suggest replacement of variables in a construct, or rewording of a variable or conceptual modification of a basic construct. Neither of these kinds of changes, nor rejection outright of any part of the model, would be warranted, however, without further data from larger populations (for increased variance) and from comparisons with different learning style indicators. These points will be elaborated upon in the summary chapter.
Measuring Person-Environment Interactions in Learning Situations

The purpose of this chapter is to begin to examine the extent to which the model of learning environments being developed in this study can be used to predict or explain certain learner behavior. Having assumed from the previous two chapters that the Learning Environment Diagnostic (LED) tool, and the model underlying it, does begin to measure course environments in terms that are relevant to different types of learners, this discussion will center on whether or not any relationships exist between a type of environment, a type of learner, and that learner's satisfaction, perceived value of things learned, or performance in that environment. An initial attempt will be made to test for "matches" or predicted relationships between a type of learning and a type of environment that would result in higher satisfaction, performance, etc. than from some other combination of P and E factors. It is understood that, at this point, the LED measures are not fully valid and are in need of modification and further testing. Nevertheless, given the partial evidence of expected relationships thus far, some evidence of P-E matches should also be expected.

Methodology

All students responding to the questionnaire described earlier (see Appendix B) were asked to rate each course they were presently taking according to:

(1) how much they liked it on a seven point scale (1 = "did not like it at all," 7 = "liked it very much"); and
(2) the degree to which they learned anything of value to them from the course, again on a seven point scale (1 = "didn't learn anything of value to me," 7 = "learned a great deal of value to me"). Faculty members in each of the ten courses observed using the LED were also asked to rank order their students according to whatever criteria they would use to characterize a student as "most like" or "least like" the "ideal" student. This strategy was adopted primarily because there was no other available means of differentiating student performance. Grades in this department were given with the assumption that any student accepted into this department was at least a "B student" so that with very few exceptions most grades were either "A" or "B."

Due to the small sample size (N = 40) any analysis of results by individual course would yield subsamples as small as 3, 6, or 7 students for a particular course. To be able to deal with larger subsamples, and potentially more meaningful data, various courses were grouped according to their predominant type of orientation. Taking the ten courses measured using the LED (see Chapter III, Table 4), the actual LED scores were used to group the courses into different types of environments:

(1) Behavioral environments were most characterized by courses A, B, and C which received the three highest scores on "behavioral orientation."

(2) Symbolic environments were defined as courses D, E, and H which received the highest scores for "symbolic orientation" of all the courses (Course H was equally rated as symbolically and perceptually oriented).

(3) For Perceptual environments courses F, G, and H were considered
because they scored highest of all ten in perceptual orientation. Courses I and J were not used for this analysis because the LED measures differed more from student ratings than in the other cases.

Learners have been grouped according to their predominant score on each of Kolb’s two LSI dimensions: concrete versus abstract and active versus reflective. The "more concrete" learners are those with AC–CE scores greater than or equal to the population mean (−2.6) and the more "abstract" have scores below −2.6. Similarly the "more reflective" learners are those with AE − RO scores greater than −3.06, the population mean. Thus the total population in a particular kind of environment can be viewed in two ways: separated according to an abstract-concrete distinction or a reflective-active distinction.

Results

A. Behavioral Environments

Learner satisfaction and perceived value of things learned from predominantly Behavioral environments is shown in Table 19. The expected "match" in this instance would be with the more active learners (i.e. AE score greater than RO score on Kolb's LSI). The results show this to be the case for satisfaction. The more active versus reflective the learner in this sample, the more satisfied they were with these kinds of courses. In terms of perceived value of these courses, no clear differences emerge. The more active (as expected) and more abstract the learner, the more they report high value, but only slightly over that of other learners.
Table 19. Learner Satisfaction with and Perceived Value of Behaviorally Oriented Environments.

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<tbody>
<tr>
<td>Mean Satisfaction Score</td>
<td>5.08</td>
<td>5.27</td>
<td>5.54</td>
<td>4.64</td>
</tr>
<tr>
<td>Mean Perceived Value Score</td>
<td>5.25</td>
<td>5.79</td>
<td>5.67</td>
<td>5.36</td>
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*Course A: Aff. score = 23, Beh. score = 28, Perc. score = 18, Symb. score = 11
Course B: Aff. score = 24, Beh. score = 28, Perc. score = 16, Symb. score = 21
Course C: Aff. score = 24, Beh. score = 31, Perc. score = 19, Symb. score = 21

B. Perceptual Environments

Table 20 depicts learner satisfaction with and perceived value of Perceptually oriented courses. Here the expected "match" or higher score for the more reflective learners did not materialize. In fact, the more reflective the learner on the LSI scales the less satisfied they were, of all learners, with these kinds of environments. The more abstract learners valued these courses the most. This may reinforce the discussion at the end of Chapter IV where some overlap was suggested between the Symbolic and Perceptual constructs. These environments may not be offering full opportunity to reflect and discover as much as encouraging the use of concepts in problem solving, thus improving learner skills in handling abstract data, symbols, theorems, etc..
Table 20. Learner Satisfaction with and Perceived Value of Perceptually*-Oriented Environments.

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<tbody>
<tr>
<td>Mean Satisfaction Score</td>
<td>5.09</td>
<td>5.07</td>
<td>5.07</td>
<td>4.73</td>
</tr>
<tr>
<td>Mean Perceived Value Score</td>
<td>4.50</td>
<td>5.57</td>
<td>5.07</td>
<td>4.64</td>
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</tbody>
</table>

*Course F: Aff. score = 15, Perc. score = 23, Symb. score = 17, Beh. score = 16
Course G: Aff. score = 14, Perc. score = 21, Symb. score = 15, Beh. score = 6
Course H: Aff. score = 15, Perc. score = 23, Symb. score = 23, Beh. score = 14

It is also interesting to note that concrete and abstract learners were equally satisfied with these environments, but far apart in their assessed value of things learned. Considering the hypothesized indicators of a perceptual orientation, this makes sense. Abstract learners would be expected to put a higher value on learning how and why concepts relate to one another, learning new perspectives with which to conceptualize a problem, etc., while concrete learners would value these less until they were applied in the context of a problem that the learner could identify with personally. The same concrete learner could remain satisfied with the environment so long as there were some aspects to get involved in on a moment-to-moment basis. Thus participating in group discussion could be satisfying as a "here and now" experience (i.e. an affective element), but unrelated to anything of value taken from that experience.
C. Symbolic Environments

For this type of environment, the more abstract learners are expected to rate satisfaction and value higher than other types of learners. Table 21 shows this to be the case for satisfaction, particularly in comparison with the more concrete learners. The abstract learners also value these environments more than concrete learners as would be predicted, but not quite as much as do the reflective learners when the division of the sample is changed. So again, there is the suggestion of some overlap between what the symbolic and perceptual measures are picking up in these courses.

Table 21. Learner Satisfaction with and Perceived Value of Symbolically*-Oriented Environments.

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<tbody>
<tr>
<td>Mean Satisfaction Score</td>
<td>4.77</td>
<td>5.78</td>
<td>5.44</td>
<td>5.27</td>
</tr>
<tr>
<td>Mean Perceived Value Score</td>
<td>5.44</td>
<td>5.77</td>
<td>5.56</td>
<td>5.86</td>
</tr>
</tbody>
</table>

Course D: Aff. score = 9, Perc. score = 12, Symb. score = 31, Beh. score = 23
Course E: Aff. score = 11, Perc. score = 21, Symb. score = 28, Beh. score = 23
Course H: Aff. score = 15, Perc. score = 23, Symb. score = 23, Beh. score = 14

The relatively high value rating by the concrete learners compared to their lower satisfaction score also speaks to what the Symbolic orientation is picking up. Unlike the hypothesized Perceptual orientation
where there is no problem focus and where concrete learners would be satisfied with the experience, but perceive little value in what was learned, the Symbolic orientation is hypothesized to be solution focused. Hence while concrete learners would not necessarily like dealing in abstract data with rules, theorems, and methods to follow to get a right or wrong answer, they may still value the learning if it is used to solve a problem they can relate to some real setting. Looking at the courses being considered in Tables 19 and 20, this is the case. The Perceptually dominant courses (I, H and G) were a seminar on the management of landscape architect firms (primarily open-ended case discussions), a technical course on land resource analysis (focus on learning terminology, literature sources, etc.), and an overview course with invited practitioners to talk about current events in the profession. Contrasted to these were the Symbolically predominant courses where two of the three (D and E) were sequential courses in the application of computer modeling to large scale site planning. Both courses had specific problems to be solved weekly with best and worst quality solutions. There were few open-ended discussion or "think sessions," and although the data was primarily abstract, the problem was a real land site the students could visit, see, touch, etc.

D. Affective Environments

As discussed earlier in Chapter III, there were no predominantly affective environments of the ten courses measured with the LED. If one assumes for the moment that the hypothesized "match" between the more concrete learners and these kinds of environments is valid, it is useful
to look at the results of this type of learner in Tables 19, 20 and 21. The more concrete versus abstract their learning style the less they are satisfied with behavioral and symbolic environments. The latter result would be expected: that concrete learners, who supposedly relate best to affective environments, would be least satisfied of all with symbolically-oriented courses. They do, however, see value in things learned in that kind of setting. The concrete learners’ ratings of perceptual environments are also interesting. They are as satisfied as their counterparts in learning style, but see the least value in these courses. Perhaps the instructors are not functioning in ways to help make conceptual discussions, hypothetical relationships, or new perspectives "come alive" or relate to real "here and now" issues for these learners. Consequently, they do not value what is learned or intended to be learned. This might explain the overall low ratings given to several of the teacher role measures and/or the overall lack of highly affective environments in this department: there is an absence of a particular teacher role that would help make any environment more sophisticated in the affective domain and thus more useful to concrete learners. The role would appear to be some combination of interpreter, practitioner, and user of theory who could be a model for this kind of learner.

Learner Performance and Environmental Orientation

Only two of eight faculty members responded to the author’s request to rank order their students along whatever criteria they desired. One faculty member went so far as to complain to the chairman of the department that such rating was detrimental to the learning process, even though he had agreed to the idea in a prior, taped interview with the
author. It appeared as though the basic issue of evaluation was a sensitive one for this particular department. This may have to do with the nature of the field itself. Some faculty members did admit to not wanting to judge "art" or evaluate the results of the design process. Yet in interviews with the author, most said that they could judge one student's output versus another's in terms of its "professionalism" or how it would fare if they were a business colleague of the faculty member.

The performance data obtained is presented in Figure 10 in order to visually indicate relationships between learner style and environmental orientation. Each learner ranked by this instructor is plotted according to his learning style as was done in Chapter IV. The relative degree to which this course is oriented in the four domains of our model is also superimposed on the same grid. Finally, the symbols depict the ranking of the student: either "top 15%," "next best" (51 to 85 percentile), or "lower half" (0 to 50 percentile) of the class.

The course is course D in Table 4 (page 87) which was rated by the LED as highly symbolic (31) and next most behavioral (23). The student sample from that course rated it as most perceptual and then symbolic. It is an introductory course in the use of computer technology to simulate land resource analysis and site planning. As discussed previously, the "first look" at the computer may be the perceptual aspect and a valid shortcoming of the perceptual measures first used in the LED. So the course may be more perceptually oriented than pictured here and perhaps less symbolic. It is thus "complex" in that it has predominate aspects in three of four possible orientations.

The predictions would then be that abstract learners would perform
Figure 10.
Learner Performance as a Function of Environmental Orientation and Learner Style.

Instructor Rankings:

- Top 15% of Class
- Next Best
- Lower 1/3 of Class
better than concrete due to the high symbolic orientation, and of these learners those with high reflective or active abilities could do well, depending on the instructor's criteria. In this case, the main positive criteria included "visible growth in terms of reassessment of assumptions, attempts at resolution/synthesis of ideas and concepts, and then some visible level of competence vis a vis technical assignments."

On the negative side was "I dislike students who are not open to new approaches and see themselves as 'designers by divine right.'!"

Given this, the results in Figure 10 are encouraging. One of the top two performers is a Hi AC learner as would be predicted. All other abstract learners rank in the top half of those evaluated except one who the instructor noted as a foreign student who had "serious language problems." Also in the top half category are Hi RO and Hi AE learners. Given the criteria for evaluation, these would fit the prediction. They are more abstract than concrete and either demonstrated the reflective abilities to entertain new perspectives, test assumptions, etc. or the active skills in demonstrating competence in using the computer. Most obvious is the low rating of the highly concrete learners which supports the hypothesis that their style of learning least fits this type of environment.

Discussion and Summary

Although admittedly a crude attempt to test for P-E matches using the model of environments being developed in this study, the results above do offer some support for the basic notion of a "match" relating to higher satisfaction and performance. Both Behaviorally and
Symbolically oriented courses were rated highest in satisfaction by the predicted type of learner, thus supporting the general validity of these constructs and their indicators. The Perceptually oriented courses were not as satisfying as expected to the more reflective learners. This reinforces earlier observations that the indicators of this type of orientation may be overlapping with the symbolic and affective indicators. Nothing can be concluded about matches in predominantly Affective oriented environments because none were measured in the sample of ten courses observed. There were indications from concrete learners' relatively low level of satisfaction with symbolic environments (expected) and low value of perceptual environments (unexpected) that either the construct is missing the proper teacher role indicator or that the results are an evaluation of the actual lack of a teacher role in these courses that would help make abstract issues and discussions meaningful to concrete learners.

These results and the one case of matching performance data with a type of environmental complexity suggest cautious optimism for the long-term goal of this inquiry. At this point there appears enough evidence to support the basic notions of the model of environments underlying the LED. Certain constructs, particularly the Perceptual and the Symbolic, appear to need modification. Nevertheless, if larger scale studies can be done with more participation by faculty with specific evaluation criteria, the direction of inquiry started in this chapter could be a productive one. Data such as that in Figure 10 could be very useful to teachers and learners alike to help explain what is occurring in the teaching-learning process, and why.
The next chapter will focus in more detail on the implications of these findings for modification of the LED and further study and inquiry in these areas.
Toward a Model for Designing Learning Environments: Discussion of Results and Conclusions

Introduction

This chapter summarizes the author's findings based upon the empirical results presented in earlier chapters, the author's subjective inferences about anecdotal data and experiences he had while collecting the data for this study, and related findings in the literature. At the risk of overgeneralizing from the study of one graduate level department turning out new professionals, this discussion will use the results of this study to expand upon the earlier model of learning environments. A revised model will be presented with recommendations for using it to further the understanding of the teaching-learning process in formal, professional learning programs.

Areas of Variability in Learning Environments

The results in Chapter IV indicate that certain aspects or variables in courses can be measured through observation. In theory, these variables are present in the environment with or without the learners. Thus they are, by definition, independent of learner behavior. The intended purpose of major activities, the teacher roles, the rules for learner behavior, the principal nature of information dealt with, and the potential for feedback are all essentially predetermined characteristics of the environment that an observer, using an instrument like the Learning Environment Diagnostic, can measure. The ability of the learners in this study sample to classify their courses similarly to the observer, using
the same constructs and variable indicators further suggests that these characteristics of learning environments are relevant because they depict environments in ways that the learner can also conceptualize. Whether or not learners naturally tend to think about their environment in this manner is a point for later discussion, but the results of this study indicate that they are able in most cases to both differentiate their courses using the categories of variables in the LED and differentiate amongst these areas in terms of how each affects their overall capability to learn.

Thus the results of this study suggest that a course can be viewed as having the following five areas of variability as givens, before any behavior on the part of the instructor or learner takes place:

A. An intended purpose for the major sets of planned activities;

B. A predominant source or type or information to be dealt with;

C. A set of expected rules or guidelines to govern learner behavior;

D. A primary teacher role that the instructor expects to fulfill in the teaching-learning process;

E. A potential mode or mechanism for feedback to the learner to evaluate his performance.

The results of learner perceptions as to how each of the above variables helps their ability to learn indicate that these independent qualities of learning environments differentiate learners in the following ways:

**Major Purpose of Activities:** Some events or tasks that learners engage in are designed to help them to understand or to conceptualize certain relationships between things, while other activities are aimed at
giving the learner an opportunity to do something that is similar to what he would do in real life in order to apply knowledge or skills that he is trying to master. Still other (and sometimes the same) activities are aimed at getting the learner to think about how he feels when he does apply or try to understand something. He is encouraged to focus on the experience itself and how it affected his attitudes, emotions, opinions, etc. These three kinds of purposes appear to help different kinds of learners. Focusing on understanding is seen as most helpful by reflective and abstract learners. Striving to actually do something that requires using the "tools of the trade" is seen as most helpful by the active learner. Experiencing an event, being introspective about an activity in order to determine its value to the individual is most helpful to the concrete learner. Finally, the fact that an event is seen to have a specific outcome is also significant. All learners thus rated "solving a problem" as very helpful to them.

Type of Principal Information Being Deal With: Some dialogue is expected to occur between the learner and his environment and is thus encouraged via written assignments, readings, peer discussion groups, group reports, lectures, question and answer sessions, tutorials, etc. The information that is intended to be generated and dealt with in these instances can take one or more forms. It can be here-and-now as is the case with the spontaneous expression of one's opinion, feeling, idea, or question. It can be conceptual or abstract in that it is nonpersonal and of the past or future as in reading or writing about something. The information can be focused on how or why something is, as in a written essay, a seminar discussion, or a question session
after a lecture, or it can focus on the process of doing something as in a case study, project, or experiential exercise. Certainly most information is some combination of all these types, but different learners do seem to be attracted to dealing with one type over another. Concrete learners see the immediate, personal, here-and-now information as most useful, while abstract learners rate the impersonal, there-and-then information highest. It seems that if they are trying to clarify theories and conceptual relations, they do not wish them to be cluttered by subjective opinions, feelings, etc. Information focused on the process related to doing some finite task is seen as most helpful by active learners, while reflective learners, on the other hand, seem to prefer to deal with information centered around how or why something exists or occurs.

**Rules or Constraints Guiding Learner Behavior:** Even before the learner gets into the environment there are implicit expectations or even necessary requirements that the instructor and institution desire the learner to adhere to during the learning process. Most professions, for instance, are characterized by some unique set of jargon, accepted symbols for communication, and rules of inference or axioms that serve as tenets for those who practice in the profession. Requiring the learner to memorize and use these rules, words, terms, etc. in the classroom and in related work is seen as helpful by all but the reflective learners. Most influenced by this "guide" to their behavior are the active learners who probably feel that a learning activity is even more realistic or like the real world if they are talking and adhering to rules that the real world professionals do. Reflective learners
may not be helped as much by this type of behavior rules because they learn from examining the very assumptions, values, theories, etc. that led the profession to adopt a particular axiom or jargon in the first place. The type of environmental rule (or nonrule) that requires the learner to be responsible for his actions over a period of time was rated most useful by active learners probably because, as above, it more closely simulates a real professional situation. They appear to benefit from a degree of autonomy or lack of classroom constraints more than other types of learners. This is freedom in the sense that, given a specific target or task to accomplish, they are left to themselves to get it done rather than being guided or pushed along with a schedule or series of lack-step events (e.g. everyone turns in a problem definition paper, then everyone generates alternatives at the same time, etc.). Requiring the learner to take a personal position on an issue or to express his personal reaction to an experience he has had in the learning environment is another factor which appears to be differentially useful to learners. All but abstract learners see this as useful and reflective learners see it as most beneficial to them. If the latter type of learners are trying to understand how or why something is (their preferred purpose of activity), then this is more likely to occur if they are encouraged and supported to air their personal reactions, opinions, etc. about a particular subject. Thus peer group discussions similar to Abercrombie's designs (1970) or expository essays might serve to influence behavior that's useful for reflective learners but threatening or just irrelevant to the abstract learner who prefers to deal with objective criteria and empirical
(abstract) facts.

**Potential for Feedback and Evaluation:** This appears to be an overall necessity for all learners. The less specific the outcome measures and the more ambiguous the instructor's criteria for evaluation, the less satisfied the learner. This trend is supported by the findings in Chapters V and VI and in anecdotal write-in comments on several questionnaires returned by students in this study. These comments were all concerned with the extent to which there was a lack of any relevant feedback or evaluation built into a particular course or, in one case, into the entire curriculum. Where some format is set up for feedback to the learner, certain types or methods were seen as more helpful than others. Personalized feedback from instructor to individual learners was rated highest by all types of learners. Being judged as right or wrong (e.g. pass-fail, winner-loser) was generally rated as least helpful. Helping the learner to develop his own criteria for self-evaluation was seen as particularly helpful by active learners. For the active learner, these criteria are likely to be his priorities from a set of external indicators of relevance that real professionals face, as opposed to external criteria that students may face. Hence competing with peers for one instructor's rating which could lead to a good grade, good recommendation, etc. may not be as meaningful to the active learner as would be having potential buyers or users of his product judge its merits versus those of his peers.

**Teacher Roles:** The results of this study indicate that the role that is seen as most helpful by all learners is one where the teacher is able to advise, coach, or help the learner in a one-on-one context and
is also able to serve as an example of the profession. Pavnick's study of medical students (1974) found that such "role models" were important to the concrete learners in their career specialization selection process. Just how teacher roles impact upon such choices in landscape architecture was not a focus of this study, but it may be that this factor plays a significant part in the choice process for all learners. On the other hand, the relative impact of teacher role on such choices may be dependent upon the number of teachers to choose from and frequency of teacher-student interaction. In this study, the faculty was small and the learner was likely to have many interactions with just two or three different faculty members over a term. In medical school, the student might encounter three to four times the faculty, but many less times each. Thus aspects of the larger, institutional environment surrounding the learner (e.g. medical school, landscape architecture department) may affect the degree to which this teacher-role factor influences the learner in a single course environment. Within the context of the course, however, the friendly, helpful, leader-by-example type of teacher was preferred by all learners over the taskmaster, enforcer of time, expert authority, and the nondirective, intuitive type of teacher. Abstract learners did see the enforcer role as a useful one and the reflective and abstract learners saw the expert authority or interpreter of a field of knowledge role as helpful, but less so than the "role model" described above. These results may be saying, simply, that a teacher's competence (both as an expert and as the manager of a classroom), is seen as useful to some learners only when it is presented to the learner in a personal
context where the learner feels that the teacher is sincerely interested in him as a future professional. Otherwise, whatever expertise or knowledge that the teacher is trying to convey might just as well be conveyed through a reading, a tape recording, or written material.

The Interactive Characteristics of Learning Environments

The "independent" nature of the area of environmental variability described above stems from the fact that they can be observed and measured by an independent observer of the teaching-learning process and that, in theory, they exist in some form prior to the learner's entry into the environment. Support for this latter point comes from the derivation of these factors from the literature and from the fact that faculty could describe their courses in these terms before the course actually occurred. In actual practice, it is obviously difficult to separate out totally what is a predetermined environmental characteristic from what is the result of an interaction between the learner and the environment. For example, having a peer discussion after a lecture to examine the learners' feelings about the topic and issues discussed may be potentially more helpful to concrete and reflective learners than to abstract or active learners, but unless the actual interaction between those peers in this discussant mode is of a certain level of quality, even those learners who are expected to benefit most may evaluate that experience as being of little value or less than satisfying. Hence the efforts described in Chapter VI to identify "matches" between types of learners and types of environments may be misleading even if they were supported by data from a larger sample of students.
Consider the following dilemma concerning the concept of a person-environment match. In this study, environmental variables thought to exist independently of a person-environment interaction were used to measure and typify courses. Learners were asked to rate these variables, in general, as to the impact upon their ability to learn. From an analysis of these results, potential matches between types of learners and types of environments are implied which would lead to increased ability to learn by the student. Then students are asked how satisfied they are with and how much they valued specific courses. Comparing these results against the hypothesized matches is basically testing the degree to which potential (expected) interactions between learners and their environment were actually realized — not testing for the validity of the hypothesized match itself.

It is difficult to imagine how one might test for the validity of potential matches without observing actual interactions. Rather than getting student perceptions of "matches", it may be necessary to develop schema for observing students in their environments and thus measuring person-environment interactions much in the same way that the environment has been successfully measured in this study.

If this notion of the gap between potential and actual matches or interactions is valid, it may help to explain the results in Chapter VI where behaviorally and symbolically oriented courses were valued more overall than perceptually oriented courses and where, in general, active
and abstract learners appeared to be more satisfied with their (potential) matches in environments than did the reflective learners with the perceptual courses. The earlier discussion of environmental orientations in Chapter III suggested that a perceptual situation, one that supposedly caters to reflective learners, would be one that included peer discussions of how-and-why questions and one that supported expressions of personal feelings and opinions. Although such a discussion can be planned and set in motion, the quality of the resulting dialogue is very dependent upon the students' and instructors' abilities in group settings. Thus there is great room for a discrepancy between a potentially useful group interaction and one that results in high satisfaction and high perceived value by those learners who probably have highest preference for this kind of activity. If, in fact, these learners (reflective) are thought to benefit most from this aspect of an environment, they would also be expected to be the most evaluative of it. In a behavioral or symbolic environment however, where the learner works more by himself, it may be fair to assume less room for "error" between what is possible and what actually occurs. So the particular results of this study may reflect upon the capabilities of this particular faculty in being better suited to serve as coaches to individuals in the behavioral environments and to teach abstract technology in the symbolic environment than as facilitators to team efforts or to peer discussions in the perceptual environments. This, coupled with little or no exposure of the students to group dynamics or to the processes involved in working with peers, could account for the absence of predicted matches between the perceptual environments and the reflective learners and their low ratings of value and satisfaction with these courses.
The conclusion here is not that person-environment matches are meaningless, nor that they do not exist in graduate level professional education. This study has pointed out, however, just how complex the investigation of such matches can be. It appears that they must be tied to specific outcomes in order to be measured, as discussed in Chapter VI, and that one must attempt to establish an observational scheme for objectively measuring what learners do in various situations rather than relying solely upon reported learner satisfaction or perceived value of an event.

The Structure of Learning Environments: A Revised Model

The model of learning environments put forth in Chapter II described four domains or types of environmental orientation that were theoretically linked to four different modes of learning as measured by Kolb's Learning Style Inventory. The results in Chapters IV and V offer support for this model. It was possible to independently measure behaviorally, symbolically, and perceptually oriented course environments. Closer examination of student perceptions and evaluations of the constructs and the variables used to measure these environments, however, leads us to a new typology that is slightly altered from that in Chapter II.

The following are descriptions of distinct types of environmental orientation hypothesized to exist as a result of this study:

A. Behavioral-simulative orientation - This is much the same as the "behavioral" environment derived from the earlier model. The intended purpose by the designer of such a setting is to allow the learner to apply
some knowledge, skills and attitudes to a problem or task in such a way that the problem and process of application closely resembles what one would be expected to do in the real practice of the profession. The learner is basically left alone to plan and do his work within only basic time constraints from the teacher. The teacher(s) is available to help as a coach or to offer personal experience as a means for idea generation or comparison to help the learner along. The output of the setting is clear and concrete. It is a written or verbal report, a design, or a solution that the learner has attained in answer to some real-life-like question or client need. The output is evaluated much like it would be in the profession and the learner is left to conclude for himself the ultimate quality of his work based on his acceptance and prioritization of criteria being used by the profession. Such an environment would be most like a practicum or internship in many professional schools. A "lab" might also represent these characteristics if the subject matter and process were realistic and pragmatic.* In terms of Kolb's LSI scales, both his Accommodator (active-concrete learner) and his Convergers (active-abstract) would probably appreciate this orientation the most. The accommodator would value the simulation of real life aspect while the converger would value the pragmatic test of theory, concepts, or analytic abilities. Specific indicators of Behavioral-simulative settings would be (original indicators in parentheses):

Bl - Intended purpose is to apply knowledge and skills to solve a real life problem in ways that a professional would.

(same)

*The author uses these common terms only to help in envisioning the environment being described. The findings discussed in this chapter also support the notion that a "practicum" or "lab" can also be oriented in other areas at the same time that it is behaviorally oriented.
B2 - Principal source/focus of information stems from that necessary
to do plan, schedule, or do work or to write/present output.
(same)

B3 - Learner behavior is essentially autonomous: most actions are
dependent upon previous decisions he has made.
(same)

B4 - The teacher is a coach who guides by offering friendly advice
or reactions based on personal experience as a professional.
(Teacher is a consultant/coach available at learner's request)

B5 - The learner is left to ultimately judge for himself using those
criteria used in the profession which he accepts as valid.
(learner output is evaluated or tested against criteria of relev-
ancy or practicality)

B. Symbolic-mastery orientation - This type of environment is not as
abstract or purely conceptual in its focus as that imagined in the pre-
vious model. The intended purpose of the designer of this environment
is to get the learner to master necessary knowledge and skills that are
the "tools of the trade." Hence requiring the memorization of terms,
symbols, axioms, references or learning and practicing how to properly do
research in the field are activities in this type of setting. The em-
phasis on "mastery" versus "knowing" implies that the learner not only
thinks about something but uses it in some way to test his skill level
with it (e.g. writes a computer program in order to test his understand-
ing of how to use the computer). Where the emphasis in the Behavioral-
simulative environment was on being like a professional, the emphasis
here is on mastery, so the context within which the learner applies some
knowledge or skills may not be dissimilar to the real world. The teacher
in this setting serves as a role model by emphasizing the relation of
whatever concepts are being learned to the practice of the profession.
He is an "expert" in the sense that the learner has no other opinion to
rely upon, but his expertise in this environment still depends to a degree on how much he can personally relate to the learner as a friend, concerned with the student's progress as a professional. The environment would necessarily present information of an abstract nature (e.g. data, research, past examples, theories, technological reports, etc.) for the learner to focus on, as opposed to the Behavioral-simulative instance where he focuses more on what is happening at the moment in his work. Also, the Symbolic-mastery environment is likely to control the learner's activities more, in that the field (through the teacher) determines the best sequence to learn or practice things in. Finally, outcomes are usually specific answers to problems and thus tend to be measured by exams, or papers that require memorization, utilization of jargon, and demonstration of understanding to get a result that can be objectively evaluated against theoretical/conceptual standards. This environment should match best with convergers (abstract-active) and pure abstract learners on Kolb's scales more than abstract-reflective ones.

More typical labels of course activities that would be primarily symbolic-mastery oriented would be lectures, problem-homework assignments, research projects, computer work, business games (could also be behavioral but for typically excessive control over the procedures and methods), etc. Specific indicators of Symbolic-mastery settings would be:

S1 - Intended purpose of major activities is to master a skill or concept by using it to solve a problem.
(Purpose of major activity is to solve a problem)

S2 - Principal source of information is abstract, objective, and past or future oriented.
(same)

S3 - Learner behavior is guided by terms, rules of inference, and
strict problem solving methods.
(same)

S4 - Teacher uses expertise to interpret body of knowledge for learner and to guide or direct learner in manipulating term, concepts, etc.
(Teacher is an organizer/taskmaster. Teacher is the final authority)

S5 - Output is evaluated as correct or incorrect by objective criteria based on axioms or rules or the field.
(Output is evaluated as right or wrong)

C. Reflective-investigative orientation - This environment stems from the analyses of results in Chapters VI and VII having to do with "perceptually predominant courses" which appeared to be least valued and not satisfying to reflective learners on Kolb's scales, as had been expected. It appears that these learners are either interested in examining themselves or their own opinions, ideas about a field or topic or they are interested in "reflecting" or examining certain underlying concepts or assumptions of the field, but from an impersonal, abstract point of view. The intended focus of this orientation would be toward the latter: the scientific and impersonal examination, analyses, and synthesis of assumptions, values, tenets, axioms, etc. that form the basis for the profession or disciplines. To accomplish this, the events in such an environment are a mix between structured interactions or dialogues where the learner espouses his beliefs, opinions, or interpretations and situations where the learner takes in information from books, lectures, research, etc. The role of the teacher is to provide enough direction and closure to the process of examining such abstract topics so that the learner does not feel too frustrated with the open-endedness or ambiguous nature of such discussions or seminar sessions. Also, since the evaluation of the learner's work is basically up to him (e.g. to form his own theory or to
specify his own set of ethics for the profession, etc.) the teacher needs to help the learner to define learning goals and criteria he will use to measure his progress. This kind of environment would be most congruent with the reflective-abstract learner (the Assimilator) in Kolb's terms. It would involve more interactions between peers than the two previous orientations because of the emphasis on identifying, showing, and comparing points of view to come up with one's own. Typical settings with this orientation would be lectures and seminars integrating literature in the field, reading assignments, presentations or exposure to new techniques or theories, basic experimentaiton, etc. Specific indicators of this orientation would include (old indicators in parentheses):

R1 - Major purpose of activity is to derive or understand a concept or relationship between concepts or events.
(Major purpose of activity is to understand something)
R2 - Major focus of information dealt with is on "how" or "why" things occur or relate.
(same)
R3 - Learner is encouraged to try out new perspectives or ways of thinking about the subject.
(Learner is encouraged to listen, watch, read, etc. in order to take on multiple perspectives toward the subject matter)
R4 - Teacher offers direction and closure to open-ended or abstract discussions.
(Teacher is nondirective)
R5 - Learner learns to use professional standards or criteria of the discipline to evaluate performance.
(Learner determines own criteria of relevance)

D. Affective-self-analytic orientation - This type of environment is least connected with the results of this study. The author's inability to measure a predominantly affective course in this study may be due to the nature of the particular test site, but it could also be that such a setting is not confined to the boundary of a "course" and is rather a
potential element of the larger environment: the department, or school itself. The purpose of this environment would be to provide the learner with an opportunity to realize how he feels vis a vis becoming a professional; how he relates to the faculty as potential colleagues; how he feels about the profession in society; which particular career path does he wish to take within the career; how does one get started; etc. This type of environment would focus on creating situations where the learner had to experience something related to being a real professional and then discuss or communicate his feelings, values, ideas resulting from that experience. This could occur in meetings with faculty, tutorials, projects, simulated exercises, guest lectures, field trips, interviewing for jobs, seminars on career choices, teaching and research assistantships, etc. Since many of these events need not be formally part of a course in order to occur, this type of environment may be more accurately measured by going outside courses as well. Another way to view this aspect of learning environments is to say that the major impact of so-called office hours, informal lunch hour activities, and other non-course entities may be to foster the learner's self-assessment of his personal feelings about the field or profession. The faculty role in this environment is as a role model, one who personally relates to the learner as an advisor or career counselor and as a friend. The outcomes to be evaluated in this environment are the most ambiguous of all the environments. Basically, the learner is examining his attitudes, but straightforward attitude measures may not be enough to evaluate whether or not he has successfully initiated the professional socialization process that accompanies the acquisition and application of knowledge and
skills in the other three kinds of environments. This environment should be most congruent with Kolb's concrete learner. The reflective learner might also value this orientation since it captures part of what reflective learners were saying they liked (see discussion of reflective-investigative orientation above): some opportunity to examine themselves or their opinions and ideas concerning a topic or event. The concrete-active learner (Kolb's Accommodator) could also use activities in the Behavioral-simulative environment as the experience base for this kind of introspection while concrete-reflective learners (Kolb's Diverger) might use any experience whatsoever in his total life-space as a student as the basis for this personal attitude examination. Within a course context, the degree of Affective-self-analytic emphasis would be indicated by (old indicators of affective orientation in parentheses):

A1 - Purpose of major activity is to help learner realize and develop his attitudes toward the profession.
(Major purpose of activity is to experience what it is like to be a professional)
A2 - Source of information is "here and now", focused on personal feeling at the moment.
(same)
A3 - Learner is encouraged to express his feelings, opinions, ideas, etc.
(same)
A4 - Teacher is a friendly listener and counselor.
(Teacher is leader-by-example, a role model)
A5 - Feedback is personalized to the learner's needs at that moment.
(same)
The Complex Nature of Learning Environments

In addition to the derivation of the above "types" of learning environments, this study also supports the notion of environmental complexity: that a learning situation or a learning environment over time can be characterized by two or more of these orientations at the same time.

Although these four kinds of learning environments are measured as independent "types," in practice one is likely to find each type to varying degrees in a particular course as was the result in Chapter IV with the observer ratings of courses in the field test site. This mixture of orientations reflects the complex nature of professional learning environments where the intended outcomes for students include:

1. Acquisition and mastery of new knowledge and skills that are necessary ingredients to the practice of the profession: the environment intending to help the student do this would be primarily Symbolic-mastery;

2. Experience in applying/using new "tools of the trade" in a case, project or other application that was as much like the real life practice of the profession as was possible: primarily gained through a Behavioral-simulative environment;

3. The ability to explore and understand the underlying concepts and foundations of the field that lead to research, discovery, and innovation: gained through a Reflective-investigative environment.

4. The acquisition by the individual of attitudes and general behavioral norms characteristic of the field or profession: primarily gained via the Affective-self-analytic aspects of an
environment that may occur outside the formal boundaries of a course.

The presence of some or all of these objectives in graduate level, professional education settings (Harrison, 1969) necessitates viewing the learning environment in ways that allow for all four of the environmental "structures" described above to exist at one time, in one course, and even in one major activity or event.

It also suggests the wisdom in designing learning situations from these multiple frames of reference. Since all of the four objectives above could be viewed as necessary prerequisites to a complete learning experience (much like Kolb's experiential learning cycle shown in Chapter IV) it would make sense to incorporate events that contributed to more than one outcome into the design of a course, and certainly with respect to the design of a curriculum. The landscape architecture site for this study is a case in point. Each of the courses measured was oriented, in varying degrees, to each of the four domains in our environmental model. As a representative sample of the total curriculum, these ten courses were predominantly behavioral and symbolic, thus indicating a potential overall bias or "type" for the department and maybe for the field. Whether or not this is an appropriate bias or correct distribution of course environments is an evaluative question for another study. The implication from this study is that balance among the orientations is not so important as is recognizing learner differences, necessary outcomes, and the environmental orientations that could serve to connect the two. For one kind of learner a factual lecture on a topic may convey the necessary information and suffice as a learning experience. For another,
however, unless given the chance to discuss the lecture with peers or with the lecturer, the event would be wasted. Still for another learner the same lecture by a charismatic presenter may serve to distort the intended information because the learner was focused on the presenter versus the presentation. Discussion sessions or application exercises after the lecture might serve to counteract this effect. Thus, depending on input (the kind of learners) and output (desired information transfer) this simple lecture could be designed with a symbolic, investigative, affective, and/or behavioral orientation in mind.

Finally, all environments need not be all things to all people. It is reasonable and economical to expect that certain courses emphasize particular modes or orientations to attain certain outcomes at the expense of others. A collection of courses or curriculum, however, should probably achieve some representation of each of the four orientations in our model. A profession may be correctly "biased" in a direction such as this study site and therefore expect that most graduates attain skills in those modes or types of situations (i.e. behavioral and symbolic). Yet if learners are recruited who are more comfortable or able in work in other types of environments, they may be lost or drop out if not given a chance to move from what is comfortable (a preferred environmental orientation) to a less preferred, but more functional type of environment. An addition to this study would have been to survey the learner sample as to their overall satisfaction or identification with this particular school or the profession. The greater results would be expected of the "convergers" (abstract and active on Kolb's LSI scales) who match the predominant collective bias of the ten courses measured in the study.
In future research to validate the revised model of learning environments discussed above, this author intends (and recommends to others) to use multiple measures of learning style. While Kolb's LSI is based on a theory that is easily related to classroom learning, the instrument may be suspect with regards to what exactly it measures and how it measures. Rather than force a ranking of self-image words, it may be more realistic to allow for scaling so one could conceivably have strengths or preferences in two or more of the four learning styles. The learner is thus viewed as complex in the same way that environments have been conceptualized in this study. Also rather than self-perceptions, some behavioral or other indicator of preferred learning style would be useful to give more objective meaning and validity to Kolb's types. Thus the use of other standardized tests such as the Myers-Brigg Type Indicator, Hunt's Conceptual Level Indicator, or accepted tests of things like Divergence (Remote Associates Test) would be recommended. Beyond providing data to explain or refute the meaning of the LSI scores, such tests could be used to further understand what the environmental indicators in our model are (or are not) measuring, as the LSI results did in this study.

While refinements and alternatives to the LSI are encouraged, the lack of statistical reliability in the LSI scores is not of major concern to this author (See discussion in Appendix E.) The large degree of statistical reliability of many standardized tests of personological variables renders them less useful to the measurement of person-environment interactions, unless one assumes that learning styles are fixed traits before entry into professional education. Such an assumption is antithetical to the concept of professional
socialization. Thus the fact that the LSI proposes to measure at one point in time a personal variable that is subject to change is its greatest strength conceptually, but also its greatest weakness as a measurement tool. Asking the respondent to the LSI to rate himself with respect to a specific situation and designing alternate tests of the same four learning style constructs are recommended to deal with this dilemma. Such revisions are currently part of efforts by Kolb and others to expand the LSI.

The Boundaries of Learning Environments

While this study did not attempt to determine if course-bounded environments were more significant or greater differentiators of learner preferences than department- or school-bounded settings, the results may have implications for the definition of "learning environments". As alluded to in the hypothesized Affective/Self-Analytic orientation, certain characteristics of environments may transcend the typical 'course'. This may be particularly true as one nears the exit of a professional school and is typically more involved with individual research work, theses, and the like with a mentor or committee. While these could be considered courses, they could also be reflective of an overall approach to the total environment which is more like going to work each day than taking courses as a student. Such a rationale might explain the low response rate of the third-year students in this study site. Since few were taking courses they were hard to reach. Others may have been "turned off" to another "course evaluation form" when they no longer see themselves as in courses, per se. And the lack of any dominant Affective scores for the sample courses may have been due to not measuring for attitudinal phenomenon outside of classes and/or this not being the intended focus of courses for 1st and 2nd years students, but rather the main focus of the total environment for the third-year students.

*Personal correspondence with Professor D. A. Kolb
Measuring Learning Environments: The Ultimate Person-Environment Interaction

This author's experience in observing and interacting with faculty and students during this study indicates that students do not typically think about how they learn or about how they react to various situations in their courses. Certainly there are complaints and fears about some activities (e.g., exams), but it is sometimes difficult to collect data about learning styles or preferred course characteristics because they haven't thought in these terms before. Faculty, on the other hand, tend to be more threatened by attempts to "measure" or "assess" the teaching-learning process. Even those with explicit ideas or concepts about how and why they do what they do in their courses have difficulty seeing the kinds of measurement done in this study as nonevaluative of them.

It is therefore necessary to realize the effect of the intervention of measuring environments and learner styles upon the environment being studied. The unfreezing of attitudes and awareness of alternative ways of looking at the subject matter that can result from the measurement process are likely to have some impact upon the actors in the environment and upon the environment itself. The publicizing of the notion of potential person-environment interactions at the beginning of a course may do more to enhance the likelihood of realizing that interaction than anything else. The faculty member who incorporates the measurement of his course environment into his teaching role may ultimately affect professional attitudes towards self-assessment if this person is serving as a role model for his students.

What is probably more likely in the short run, however, is that
attempting to measure learning environments will meet with more resistance than acceptance. This is due to the nature of professions, particularly those that are academically based, to be self-governing and not open to public scrutiny. If measurement tools like the diagnostic used in this study could be adopted so that teachers could use it themselves as a "self-help" tool to run their courses, some of this resistance might be overcome.

With the growing pressures on professional educators to examine what they are doing in order to turn out young professionals more suited to meet the needs of society (Schein, 1972), it would appear necessary to examine the teaching-learning process. This study has attempted to demonstrate the usefulness of the concepts of environmental variability and complexity in learner-environment interactions in trying to understand more about this process, and has put forth a model of environments to use as the basis for measurement. In reality, the educational process at the graduate, professional level may be so complex in terms of outcomes and intervening variables that actual matches between types of learners and types of environments may never result. It is this author's conclusion, however, that if not an end, striving to discover such matches or interactions is certainly a means by which we can progress in our knowledge and understanding of the teaching-learning process in professional education.

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APPENDIX A

Learning Environment Diagnostic Tool
(Original form)
Learning Environment Diagnostic

Syntax

These questions relate to the activities that describe and distinguish this course "in action": things that tell about the shape of events learners engage in which most typify this course setting. Based on observations and assessment of how "typical" they were, determine what the "major" aspects of the session are and answer the following:

A. Intended Purpose/Objective of Activities

1. To what degree is the emphasis to achieve understanding on the part of the learner (e.g. discussion of concept; collection of information; finding/defining problems; researching a topic in the library)?

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2. To what degree are learners involved in solving a problem (e.g. there is a specific solution/result to be attained — a right answer exists)?

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3. To what degree do learners focus on experiencing what they are doing (e.g. what it is like to be in the role of a L.A.; express feelings, ideas about activities they are engaged in)?

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4. To what degree are learners actively engaged in applying knowledge and skills on a practical, everyday problem (e.g. doing a site plan or design; presentation to a client; master planning at bench; long term planning for development of site)?

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B. Principal Focus or Source of Information Being Dealt with:

1. To what degree is the source of information "here and now" or having to do with what is going on at the moment (e.g. creating or designing at learner's bench; class evaluating student presentation; visiting a site; expressing individual feelings, values, ideas, team setting goals for design project)?

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2. To what degree is the source of information abstract or "there and then" (e.g. discussing methods, concepts, looking at pictures, graphs of a site; reading or listening about something done in the past)?

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3. To what degree is the focus on the process or how something gets done (e.g. generating, discussing criteria; hypothesizing about...; reviewing progress, procedure to date; concern for approach to a problem)?

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4. To what degree is the focus on doing some task (e.g. finishing a site work-up; getting data to the computer; coming up with a master plan of...; preparing for a presentation about...; getting a paper written for...)?

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C. Intended Learner Behavior Roles:

This dimension is concerned with the extent to which "rules" govern learner activities or behaviors and where these rules come from. Answer the following with respect to what represents the primary or major activity(ies) that constitute the course (e.g. studio time at benches; "class sessions" in breakaway room; lectures; presentations; reviews; papers).

1. To what degree are activities and communications constrained/governed by rules of inference, jargon, methods, symbols (e.g. is it necessary for learners to memorize terms, labels, codes, data for recall; use complex graphical keys; have high level graphical skill; adhere to guidelines, schedules, etc.)?

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2. To what degree are learners encouraged not to act, but to observe, reflect, listen, etc. in order to determine meaning/relevance of subject matter for himself (e.g. learner is put in position to explore others' ideas, watch, listen, discuss implications, read, or write in order to select his own perspective; learner left to conclude for himself; peer differences are discussed and seen as source of learning)?

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3. To what degree does the learner make decisions/choices about what he does based on implied consequences with respect to a task (e.g. what he does now will determine -- to a large degree -- what he will have to do next; learner left to take own initiative to get something done; learners come and go as they please)?

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4. To what degree do learners express personal opinions about or reactions to course activities or to a topic (e.g. expression of attitudes, values, aesthetic concerns; evaluation of others; evaluation of content or process -- "I think, I feel that, I want to...")?

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D. Intended Teacher Role:

1. How often is the teacher nondirective/intuitive (e.g. teachers via insight or understanding; answers questions with questions; is non-evaluative; suggests versus critiques; seen as a guru, visionary, creative, etc.)?

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2. How often is the teacher a "consultant" or coach" -- available to help learners at their request (e.g. called upon because he/she represents professional values, experiences, perspectives, etc.)?

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3. How often is the teacher an "organizer" or a "taskmaster" (e.g. timekeeper; creates and enforces rules/schedules; starts and/or ends classes; terminates one activity and starts another in same session; seen as impersonal, efficient, knowledgable, a methodologist)?

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4. How often does the teacher portray (or behave like) a leader-by-example such that learners are expected to learn more from what/how he does (identification) than just what he says (e.g. models behavior, acts as if he were a professional on that problem; is a "colleague" to the learner; is committed to developing each learner's potential; is seen as personable, charismatic, a model, etc.)?

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5. How often is the teacher the "final authority" (e.g. gives the answer; ends discussions with summary; determines the right answer; interprets a field of knowledge or perspective for the learner; seen as clever, competent, etc.)?

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E. Potential for Evaluation/Feedback:

This set of questions has to do with type of feedback and/or evaluation the learner gets on a session-to-session basis: not just at the end of the total course.

1. To what degree is there personalized, evaluative feedback based on the individual learner's needs, goals, and/or abilities, from either teacher or peers (e.g. bench reviews, critiques; individual-faculty assessments, class evaluations of presentations, team review of member's performance; oral exam with teacher; setting individual goals on a project; etc.)?

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2. To what degree is there an emphasis on the learner determining criteria versus evaluating or being evaluated (e.g. peer discussions of what criteria for solution or decision should be; learner ultimately left to determine own standards/criteria for evaluation; learner evaluated based on ability to determine acceptable criteria, perspective, or approach)?

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3. To what degree is performance or decisions by learner evaluated against "right answer," one person's opinion or other explicit criteria (e.g. graded papers, projects; computer simulations; objective exams; theoretical deduction)?

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4. To what degree is learner performance/decision evaluated or tested against criteria of relevancy or practicality (e.g. "how would it work;" "is it feasible;" "how does it stack up with what ___ did;" "could it be done;" "would it sell;" more than one way to do it, etc.)?

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APPENDIX B

Learner Questionnaire
A. Course Effectiveness

Learning environments can be "effective" for different reasons. You may like or enjoy a particular course for many reasons which may or may not include its learning value to you in your preparation for a professional career. This question is aimed at finding out which courses you preferred and which ones you think you learned from.

List the names of the L.A. courses that you are currently taking (include any 3rd Quarter studies) and then rate them below in terms of how much you are enjoying them and how much you are learning in each course.

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<th>L.A. Courses (list all you are taking by name or number)</th>
<th>Degree to which I like the course (Circle one for each course)</th>
<th>Degree of learning/value I am getting from the course. (Circle one for each course)</th>
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<td></td>
<td>I did not like it at all</td>
<td>I didn't learn anything of value to me</td>
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<td>I liked it very much</td>
<td>I learned a great deal of value to me</td>
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B. Learning Environments

This section is concerned with how you relate to the events, situations, or experiences in an educational program such as this. Just what is it that helps (or hinders) your ability to learn? Whatever "it" is, it probably won't be the same for everyone and that is what we need to know. The optimal learning environment will be one which caters to different individual preferences in order to achieve maximum learning.

Listed below are several things that can characterize or distinguish different learning situations with examples of how they might look in this department. Please read each item and then indicate the degree to which you think that item contributes to your general ability to learn in any given situation.

Key:
(circle one for each item below)

0 - actually hinders my ability to learn
1 - no help to my ability to learn
2 - of little help to my ability to learn
3 - helpful to my ability to learn
4 - quite helpful to my ability to learn
5 - extremely helpful to my ability to learn

1. Purpose of major activities:

   a) the major emphasis is on understanding something (e.g. discussing a concept; collecting information; researching a topic, reading up on a subject) 0 1 2 3 4 5

   b) the major emphasis is on solving a problem (e.g. getting an answer or specific solution; solving a puzzle where there is one right way to do it) 0 1 2 3 4 5

   c) the major emphasis is on experiencing something (e.g. feeling what it's like to be a professional designer or L.A.; being able to express feelings, values, or ideas about what is going on at the moment) 0 1 2 3 4 5

   d) the major emphasis is on actively applying knowledge or skills to a practical, everyday problem (e.g. doing a sketch or site plan; presenting to a client; designing at your desk) 0 1 2 3 4 5

2. Principal source or focus of information:

   a) the information is here-and-now or has to do with what is going on at the present (e.g. creating; visiting a site; expressing feelings, values, ideas, etc. to others about course activities and what you got out of them) 0 1 2 3 4 5
b) the information is there-and-then or abstract (e.g. discussing methods, concepts; looking at pictures, sketches of site, etc.; reading or listening about something done in the past)

c) the principal focus is on the process or how something gets done (e.g. discussing or generating criteria; hypothesizing about something; reviewing previous work or progress to date; focusing on how to approach a problem)

d) the principal focus is on doing some task (e.g. finishing a site plan; getting data to the computer; getting a paper written; preparing a working sketch or presentation)

3. Rules guiding your behavior:

a) activities and communications are mostly governed by schedules, methods, or symbols (e.g. it is helpful to memorize terms, data, or jargon for quick recall; need to use complex graphical keys; need special skills; need to adhere to guidelines, deadlines, etc. due to complexity of problem)

b) you are encouraged not to act, but to observe, reflect, listen, etc. in order to select/decide on your own perspective (e.g. you are put in a position to explore others' ideas, watch, discuss implications, read or write; you are left to conclude for yourself; differences amongst students are seen as source of learning)

c) your behavior/decisions at any point in time result from (or depend on) what you have done (or decided) in the past (e.g. what you do in one studio session will determine what you do in the next one; you come and go as you please; you take your own initiative)

d) It is o.k. to express your personal feelings about or reactions to course activities (e.g. being able to express your gripes, attitudes, values, aesthetic concerns about what you are doing; evaluation: 'I think,' 'I want,' 'I feel that we should...')

4. Teacher roles:

a) the teacher is nondirective or intuitive (e.g. teaches via insight and understanding; answers question with another question; nonevaluative; suggests versus critiques; could be seen as a guru, visionary, creative)
b) the teacher is a coach or consultant — available to help at your request as well as his (e.g. they are called upon for their advice, values, perspectives, etc. as representatives of the profession)

c) the teacher is mostly an organizer or taskmaster (e.g. enforces time schedules; starts or ends class sessions; explains rules or methods; stops one activity and starts another; could be seen as efficient, knowledgable, impersonal, a methodologist)

d) the teacher portrays or behaves like a leader-by-example such that you are expected to learn from what he/she does, not just what he/she says (e.g. models behavior for you; acts as if he were a colleague to you; is committed to developing your individual potential; could be seen as charismatic, dedicated, personable)

e) the teacher is there mostly to give answers as the expert (e.g. he/she is the final authority; ends discussions with a summary; interprets a field of knowledge; determines right or best answer; could be seen as clever, competent, expert)

5. Feedback and evaluation:

a) feedback is personal and evaluative with respect to your own abilities, goals, or needs (e.g. desk crits; individual faculty assessments; oral exams; team review of member's performance; you set/determine your goals on a given project or problem)

b) you are ultimately left to determine your own criteria or standards for evaluation (e.g. focus is on you developing criteria versus evaluating; you are assessed according to your ability to determine the right question, acceptable criteria, or proper methods instead of getting an answer or final product)

c) your performance is right or wrong — it is compared to an explicit answer, one person's opinion, or other objective criteria (e.g. graded papers, projects; computer simulations; objective exams; rank ordering of student performances)

d) your performance is evaluated by or tested against criteria of relevance and practicality (e.g. there are many acceptable answers; practicing professionals are called in to assess your work; use criteria like sellability, acceptability to client, how would it work, what would happen next, etc.)
C. Specific LA: Course Environments

We would now like to get your perception of the course environments you are now in. Listed below are four descriptive statements that describe a particular kind of learning setting. Please read all four statements and then indicate -- on the next page -- which statements most characterize each course you are now taking (including 3rd Quarter studies).

Statement 1
The course is an opportunity for me to understand the relationships between concepts or to create conceptual relationships from basic information. A lot of time is spent discussing and comparing ideas, methods, etc. with other students or the teacher. There is a lot of time where I have to listen, read, or watch in order to better understand something. I am really learning how to define or approach a problem. The teacher is mostly there to give insights and to help me discover for myself. It is more important for me to understand my own criteria or hypotheses about an issue than to be evaluated for solving it.

Statement 2
The course is an opportunity for me to practice and develop my practical skills as a professional. A lot of time is spent actually doing some task that requires me to apply what I've learned. The task is usually a real-life problem where I am left to define my approach, schedule my own time to work on it, make my own assumptions, take my own initiative, etc. The teacher is there for advice and coaching, but rarely forces me to act one way or the other. My work is evaluated according to practical criteria like outside professionals' opinion, real clients' views, feasibility, sellability, etc.

Statement 3
The course is an opportunity for me to improve my conceptual problem-solving skills. A lot of the information is abstract -- having to do with past events, future hypotheses, or scientific methods of doing work. I do a lot of writing, reading, interpreting graphs, listening to lectures, etc. in order to solve a problem. It is important to memorize terms and data for recall, learn special jargon, have special skills (e.g. graphical, computer) and to have schedules or guidelines available for solving the problem because of its complexity. The teacher organizes the activities, explains and enforces complex procedures, and/or determines which answer is right or best. He/she is the one who interprets the field of knowledge being dealt with in the problem and more or less "guides us through uncharted waters."

Statement 4
The course is an opportunity for me to examine or realize my attitudes and feelings about the profession, about certain methods or skills, or about a specific problem or project. Most of the focus is on what is going on at the present -- how I react to things, what I feel like when I'm doing something, designing or creating at my desk. The teacher is like a colleague who helps me set my own goals and gives personalized feedback. The activities in the course engage me totally -- "with my gut as well as my head" -- so that I can really feel what it's like to be a professional.
Indicate below which statements on page best describe your courses:

<table>
<thead>
<tr>
<th>Courses: (same list as on page 1)</th>
<th>Statement this course is most like:</th>
<th>Statement this course is next most like:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
D. Learning Styles

This inventory is designed to assess your method of learning. As you take the inventory, give a high rank to those words which best characterize the way you learn and a low rank to the words which are least characteristic of your learning style.

You may find it hard to choose the words that best describe your learning style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to describe how you learn, not to evaluate your learning ability.

Instructions:

There are nine sets of four words listed below. Rank order each set of four words by assigning a 4 to the word which best characterizes your learning style, a 3 to the word which next best characterizes your learning style, a 2 to the next most characteristic word, and a 1 to the word which is least characteristic of you as a learner.

Be sure to assign a different rank number to each of the four words in each set. Do not make ties.

1. ___discriminating ___tentative ___involved ___practical

2. ___receptive ___relevant ___analytical ___impartial

3. ___feeling ___watching ___thinking ___doing

4. ___accepting ___risk-taker ___evaluative ___aware

5. ___intuitive ___productive ___logical ___questioning

6. ___abstract ___observing ___concrete ___active

7. ___present-oriented ___reflecting ___future-oriented ___pragmatic

8. ___experience ___observation ___conceptualization ___experimentation

9. ___intense ___reserved ___rational ___responsible
APPENDIX C

Instructor Interview Format
INSTRUCTOR INTERVIEW PROTOCOL

A. How would you describe this course to a stranger? What are its distinguishing characteristics, activities, or sequence of events?

B. Please describe the goals/objectives of your course:

C. How would you describe your role in the course? What are your primary functions?

D. How much preplanning/preparation do you do before the course begins? (Is there a syllabus, schedule, etc.?)

Was this term's schedule changed after the course began -- why?

E. How do you evaluate a student in your course?

F. What kinds of support resources (people, computer, readings, data, real client, etc.) are necessary in order to put on this course?
Instructor Self-Profile:

1. I am nondirective and try to teach by helping students to gain insights or understanding (e.g. I answer questions with questions; I am non-evaluative; I suggest versus criticize; I could be described as a helper, guru, visionary, etc.)

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<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>never</td>
<td>very few</td>
<td>seldom</td>
<td>sometimes</td>
<td>often</td>
<td>quite a lot</td>
<td>always times</td>
</tr>
</tbody>
</table>

2. I am a "coach" or "consultant" to the learner(s) -- available to help them at their request (e.g. I am called upon for my advice as a professional with certain values, experiences, or perspectives; I could be described as "a model landscape architect," etc.)

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<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
|   | never | sometimes | always | }

3. I am an "organizer" or "taskmaster" (e.g. I set and enforce schedules or rules; I start and/or end class sessions; I terminate one activity and start another in the same session; I could be described as efficient, knowledgable, a methodologist, etc.)

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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
|   | never | sometimes | always | }

4. I am a leader-by-example such that learners are expected to learn more from what/how I do things (identification) than from just what I say (e.g. I model the things I'm trying to teach; I often act as a colleague to the learner; I am personally committed to developing each learner's potential; I could be described as personable, charismatic, dedicated, etc.)

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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
|   | never | sometimes | always | }

5. I am the "final authority" in this course or on this topic (e.g. I give the right answer; I end discussions with a summary; I determine the correct solution; I interpret a field of knowledge for the learner; I could be described as clever, competent, expert, etc.)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
|   | never | sometimes | always | }
APPENDIX D

Kolb's Learning Style Inventory
Learning Style Inventory

Name ________________________ Years of Education __________
Occupation ____________________ Major field of study ________
Age _______ Sex ________________

This inventory is designed to assess your method of learning. As you take the inventory, give a high rank to those words which best characterize the way you learn and a low rank to the words which are least characteristic of your learning style.

You may find it hard to choose the words that best describe your learning style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to describe how you learn, not to evaluate your learning ability.

Instructions:

There are nine sets of four words listed below. Rank order each set of four words by assigning a 4 to the word which best characterizes your learning style, a 3 to the word which next best characterizes your learning style, a 2 to the next most characteristic word, and a 1 to the word which is least characteristic of you as a learner.

Be sure to assign a different rank number to each of the four words in each set. Do not make ties.

1. discriminating __________ tentative __________ involved __________ practical
2. receptive __________ relevant __________ analytical __________ impartial
3. feeling __________ watching __________ thinking __________ doing
4. accepting __________ risk-taker __________ evaluative __________ aware
5. intuitive __________ productive __________ logical __________ questioning
6. abstract __________ observing __________ concrete __________ active
7. present-oriented __________ reflecting __________ future-oriented __________ pragmatic
8. experience __________ observation __________ conceptualization __________ experimentation
9. intense __________ reserved __________ rational __________ responsible

CE Score: _____ 234578
NO Score: _____ 136789
AC Score: _____ 234589
AE Score: _____ 135678
Scoring the Learning Style Inventory

To score the inventory sum each column including only those words whose item number appears under the place for the total score. For example, for CE total the ranks for words 2, 3, 4, 5, 7 and 8 in the first column. For RO total the ranks for words 1, 3, 6, 7, 8 and 9 in the second column and so on. To get the combination scores subtract CE from AC and RO from AC. Preserve negative signs if they appear. (NOTE: the non-scored words in each model have been randomly assigned to other columns to disguise the pattern. Ignore them).
APPENDIX E

Discussion of Reliability and Validity of Kolb's Learning Style Inventory
LSI Reliability

The Learning Style Inventory and the experiential learning theory on which it is based present some special problems in assessing measurement error in the LSI. Concepts of test-retest and split-half reliability are most appropriate techniques for the assessment of measurement error in independent psychological traits that in theory are assumed to be fixed and unchanging. The basic learning modes assessed by the LSI, however, are theoretically independent (i.e. any action, including responding to the test, is determined in varying degrees by all four learning modes) and variable (i.e. the person's interpretation of the situation should to some degree influence which of the learning modes he used). Thus even if there were no measurement error in the LSI, one would predict test-retest and split-half reliability coefficients less than 1.0.

Test-Retest Reliability-Stability of the LSI Over Time. The most extensive analysis of the stability of the LSI to date has been done by Plovnick (1974). For a sample of mid-career managers in a one-year master's program, he found that means and standard deviations of scale scores showed little change over a seven month period (the only statistically significant difference was an increase in RO variance from 2.9 to 3.9, p < .05). In addition, however, the actual correlations between his June and December test administrations were lower than expected. They ranged from .33 (p < .02) for AE to .49 (p < .001) for CE. In a sample of master's students in management, he then did a frequency analysis to

*Subsequent to initial drafting of this study, sections of this discussion were published in Kolb, D. Learning Style Inventory: A Technical Manual, McBer and Co., Boston, 1976.
determine how many learners actually changed in designated "types" over a three-month test-retest period. Plovnick found that nine of twenty-three (39%) in the sample had crossed over the median score on one or both of the LSI dimensions. In discussing these results, he pointed out that the particular sample being studied was undergoing significant changes which could have led to changes in their learning styles and hence their LSI scores.

This latter point underlines the major concern regarding the meaning of any reliability measure of the LSI. If the trait or personological variable being measured is expected to vary according to the subject's experience, then situational changes should be expected to lower any stability coefficient. To test this hypothesis that situational factors or "discontinuity of experience" could affect test-retest scores, data from four test-retest samples have been summarized in Table 22. The prediction that test-retest correlations should decrease as discontinuity and time between testings increase is borne out.

Group one, senior medical students at Boston University, were tested three months apart and had the lowest discontinuity between their previous experience and their experience during the test-retest period, i.e. they had been medical students for four years and simply continued in that role during the test-retest period. The test-retest correlations for the combination scores are quite high (AC - CE = .61, AE - RO = .71), and those for the subscales are about the same magnitude except for CE (.48). Undoubtedly these correlations could be increased even further by shortening the time between test and retest, but the shorter time would introduce an unknown memory factor and be of questionable value in assessing any measurement error.
Table 22. Learning Style Inventory Test-Retest Reliability Studies.

<table>
<thead>
<tr>
<th>Population</th>
<th>Time between testing</th>
<th>Discontinuity of experience</th>
<th>LSI Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CE</td>
</tr>
<tr>
<td>1.*</td>
<td>3 mos.</td>
<td>Low</td>
<td>.48</td>
</tr>
<tr>
<td>Boston U. senior med. students</td>
<td>3 mos.</td>
<td>Low</td>
<td>.48</td>
</tr>
<tr>
<td>(Plovnick, 1974)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.**</td>
<td>3 mos.</td>
<td>High</td>
<td>.46</td>
</tr>
<tr>
<td>MIT MS Students in Mgmt.</td>
<td>6 mos.</td>
<td>Medium</td>
<td>.46</td>
</tr>
<tr>
<td>3.*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIT MS students in Mgmt.</td>
<td>6 mos.</td>
<td>Medium</td>
<td>.46</td>
</tr>
<tr>
<td>4.*</td>
<td>7 mos.</td>
<td>High</td>
<td>.49</td>
</tr>
<tr>
<td>MIT Sloan Fellows (Plovnick, 1974)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Reliability coefficients are Pearson product-moment correlations.

**Reliability coefficients are Spearman rank-order correlations.
The second group, where Plovnick did his analysis of frequency of change in "type," were M.I.T. master's students in an accelerated one-year program in management who were also tested three months apart, but here the discontinuity between their previous experience and their experience between tests was very high. Most of these students had been working managers before coming to the program. They took the LSI at the beginning of their program at M.I.T. and again three months later, after completing an intensive course of summer study with a heavy quantitative emphasis (see Fry and Rubin, 1972). In this sample test-retest correlations are somewhat lower for the combination scores AC - CE and AE - RO. The RO and AE correlations are also lower than the first group, while CE remains the same, and AC is greater.

The third group, M.I.T. first year master's students in the regular management program, were tested at the beginning of their studies at M.I.T. and again six months later. In this group discontinuity of experience is rated medium because most students were entering graduate study direct from undergraduate study. The test-retest correlations for this group are very similar to the second group.

The final group, M.I.T. Sloan Fellows (discussed earlier), had the longest time between testings (seven months — from the beginning to nearly the end of their studies at M.I.T.) and also the biggest discontinuity of experience — these being mid-career managers returning for a master's degree. As predicted, they have the lowest test-retest correlations on most of the LSI scales.

**Split-Half Reliability of the LSI.** A more accurate means of assessing measurement error in the LSI may be to focus on equivalence rather
than stability since what is being measured is not theoretically fixed or unchanging. The "split-half" method determines the extent to which different instruments applied to the same individual at the same time yield consistent results (Sellitz, 1959).

To investigate reliability using the split-half method, each of the four basic LSI scales have been split into halves, taking all available item statistics into consideration (see Kolb, 1976), and pairing items that most resemble each other and correlate most highly. The resulting x and y halves should therefore represent fairly the total test. The x and y halves for each LSI scale are as follows:

<table>
<thead>
<tr>
<th></th>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>receptive</td>
<td>accepting</td>
</tr>
<tr>
<td></td>
<td>feeling</td>
<td>intuitive</td>
</tr>
<tr>
<td></td>
<td>present-oriented</td>
<td>experience</td>
</tr>
<tr>
<td>RO</td>
<td>observing</td>
<td>observation</td>
</tr>
<tr>
<td></td>
<td>reflecting</td>
<td>tentative</td>
</tr>
<tr>
<td></td>
<td>reserved</td>
<td>watching</td>
</tr>
<tr>
<td>AC</td>
<td>analytical</td>
<td>evaluative</td>
</tr>
<tr>
<td></td>
<td>conceptualization</td>
<td>thinking</td>
</tr>
<tr>
<td></td>
<td>rational</td>
<td>logical</td>
</tr>
<tr>
<td>AE</td>
<td>active</td>
<td>responsible</td>
</tr>
<tr>
<td></td>
<td>experimentation</td>
<td>doing</td>
</tr>
<tr>
<td></td>
<td>practical</td>
<td>pragmatic</td>
</tr>
<tr>
<td>AC-CE</td>
<td>$AC_x^{CE}$</td>
<td>$AC_y^{CE}$</td>
</tr>
<tr>
<td>AE-RO</td>
<td>$AE_x^{RO}$</td>
<td>$AE_y^{RO}$</td>
</tr>
</tbody>
</table>

Table 23 shows split-half reliabilities obtained by applying the Spearman-Brown prophecy formula to obtained correlations between halves for five different groups; two groups of about 50 M.I.T. Sloan Fellows (mid-career managers attending a one-year master's program in management),
Table 23. Spearman-Brown Split-Half Reliability Coefficients for the Learning Style Inventory.

<table>
<thead>
<tr>
<th>Sample</th>
<th>n</th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
<th>AC–CE</th>
<th>AE–RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT Sloan Fellows</td>
<td>47</td>
<td>.69</td>
<td>.37</td>
<td>.65</td>
<td>.64</td>
<td>.78</td>
<td>.78</td>
</tr>
<tr>
<td>MIT Sloan Fellows</td>
<td>50</td>
<td>.43</td>
<td>.59</td>
<td>.81</td>
<td>.61</td>
<td>.80</td>
<td>.81</td>
</tr>
<tr>
<td>Active Managers</td>
<td>90</td>
<td>.61</td>
<td>.58</td>
<td>.71</td>
<td>.62</td>
<td>.78</td>
<td>.85</td>
</tr>
<tr>
<td>Harvard MBAs</td>
<td>442</td>
<td>.50</td>
<td>.63</td>
<td>.74</td>
<td>.67</td>
<td>.75</td>
<td>.84</td>
</tr>
<tr>
<td>Leslie Undergrads.</td>
<td>58</td>
<td>.48</td>
<td>.63</td>
<td>.74</td>
<td>.65</td>
<td>.82</td>
<td>.86</td>
</tr>
<tr>
<td>TOTAL</td>
<td>687</td>
<td>.55</td>
<td>.62</td>
<td>.75</td>
<td>.66</td>
<td>.74</td>
<td>.82</td>
</tr>
</tbody>
</table>
a miscellaneous group of 90 practicing managers, 442 Harvard MBA's, and 58 female Leslie College undergraduates.

The results show very reasonable reliability coefficients for the two combination scores of AC – CE and AE – RO. Coefficients of about .80 are consistent across all five samples and are on a par with other psychological self-report instruments (e.g. Myers-Briggs, 1962).

The fact that the CE scale shows the lowest and most variable coefficients across populations may further suggest that the LSI is biased against obtaining accurate CE measurements. The test itself is an active and abstract task (evaluating oneself according to abstract concepts) and thus a concrete person must have these abilities to some extent in order to accurately self-report his orientation. Plovnick (1974) has explored this problem by doing follow-up interviews with medical students about how they went about selecting their answers on the LSI. He found that the more abstract subjects tended to define words for themselves and then systematically apply these to a generalized self-image. The more concrete subjects tended to think of situations and apply words to them. Without any consistent definition, inconsistencies could thus arise so that "doing" would fit for one situation and therefore be ranked as 1 in a row, but "active" would get a 3 or 4 in another row because it didn't relate to whatever specific situation the subject had in mind. Perhaps a more concrete-behavioral method for ascertaining one's learning style would be a useful addition to the present LSI to try to negate this kind of bias.

Although the split-half reliability results are encouraging, there still does appear to be some basis for expecting some measurement error in the LSI which cannot be related to theoretical considerations mentioned
at the outset of this discussion. To fully assess measurement error, therefore, it is necessary to look at the construct validity of the LSI as well. For if the LSI shows a consistent pattern of predicted relationships with dependent variables, then that is an indicator that it is to some degree measuring the learning modes set forth by the experiential learning theory.

Validity of the LSI

One indicator that the LSI is able to differentiate individuals according to factors, or dimensions that relate to the learning process is the strong correspondence that exists between one's LSI scores and his academic specialization in college. Kolb (1971) plotted the LSI scores for 618 managers and graduate students in management who had also reported their undergraduate college major (see Figure 2). The resulting distribution of majors on the learning style grid was consistent with the theory. Undergraduate business majors, for example, tend to have accommodative learning styles (active-concrete) while engineers are convergent (abstract-active). Most pure or hard sciences like chemistry, physics, and mathematics fall in the assimilative quadrant (reflective-abstract). What these data show is that one's undergraduate education is a major factor in the development of a distinct learning style. Whether this is a result of the "field" or learning environment itself, or of the selection processes that put people into and out of these disciplines is an open question. Probably both factors are operating: people choose field/learning environments which are consistent with their learning styles and they are further shaped to fit the learning norms of their field once they are in it. This is not to say that students will not influence the norms and

*See Chapter II, page 47.
climate of their chosen field or environment, but that if there is a significant mismatch between their style and the field's learning norms, people will either change or leave the field. This is similar to the socialization phenomenon in organizations (Schein, 1974) and has been shown to exist as well in graduate education (Plovnick, 1971).

Biglan (1973) has attempted to do a systematic analysis of subject matter characteristics that could serve as a framework for studying how learning environments (e.g. departmental organization) differ. He had one-hundred sixty-eight scholars in a mid-west university make judgements about 36 academic areas, using a Q-sort technique. These data were then subjected to nonmetric multidimensional scaling in order to factor analyze the data or to determine inherent dimensions which would explain subjects' judgements about similarities (or differences) among the set of 36 stimulus objects. The results of this process can then be plotted in a metric multidimensional space that best fits the original data. Two of Biglan's three resulting dimensions in his "best fit" solution and the resultant plot is shown in Figure 1*. The data in Figure 1 are noteworthy in that they closely resemble the data in Figure 2 if one makes the reasonable substitution of Kolb's active-reflective and abstract-concrete learning style dimensions for Biglan's applied-pure and paradigm-nonparadigm dimensions, respectively. The correspondence between LSI scores and academic disciplines is then further substantiated by Biglan's findings which were arrived at independently without use of the LSI or any learning theory. Of the twelve common disciplines among these two studies nine are in identical quadrants. Business (assumed equivalent to Accounting and Finance) remains in the accommodative area as does See Chapter II, page 44.
engineering in the convergent area. Physics, mathematics and chemistry are very abstract in both instances and the humanistic fields like history, political science, english, and psychology remain in the divergent or concrete-reflective area. Economics and sociology did change from the assimilative quadrant in Kolb's study to the divergent quadrant in Biglan's study. These differences could be due to the particular nature of the departments involved, although this information is not available from these studies. In Kolb's sample, for example, the M.I.T. Economics Department may well have a more abstract model-oriented approach than most other economics departments.

The relevance of the LSI as a differentiator of individuals at the professional education level is seen in a study of graduating seniors at M.I.T. (Kolb, 1973). Kolb examined the correspondence between the learning styles of these students and their academic majors, and then compared these scores with those students who were continuing graduate study in their chosen field. The results of these analyses are shown in Figure 11. The correspondence between learning style and undergraduate major in this study was similar to that in the previous Kolb study.

The slightly less abstract orientation in engineering, physics, and chemistry, and the more abstract-active nature of economics is attributed to the unique characteristics of M.I.T. departments in these areas. The noteworthy results in Figure 11 are represented by the arrowheads indicating the mean LSI scores for those planning to attend graduate school in their respective fields. These data tend to support the prediction that accentuation of one's learning style would occur in going from undergraduate education in a field to the graduate/professional level in that
Figure 11. Mean LSI Scores on Abstract/Concrete and Active/Reflective by Departmental Major. (Kolb, 1976)

*Arrowheads indicate mean scores for those seniors in that department who are planning to attend graduate school. Sample size is in parentheses.
area. Accentuation occurred in at least one of the two learning style dimensions that characterize these academic disciplines for all the departments studied except for mechanical and chemical engineering. Graduate entrees into management became more accommodative (more active and more concrete) while those in physics, economics, chemistry, and mathematics became more abstract. Entrees into electrical and civil engineering were more convergent (more active and more abstract) while those into the humanities scored higher in concreteness, but lower in reflectiveness. The implications from these data for learners at professional/graduate levels with dissimilar styles from the "normative" style characterized by the discipline will be discussed elsewhere. The point to be made here is that the data suggests that the LSI does differentiate amongst individuals in ways that meaningfully relate to academic disciplines at the graduate/professional level.

Finally, it should be noted that while the LSI appears to be a useful starting point for investigating learner styles and learner behavior, any attempt to use the LSI for selection purposes without more detailed knowledge of the person and his situation is likely to be inaccurate. While group averages may yield statistically valid and replicable results, as has been presented in this discussion, the accuracy of individual scores can never be assured with a test like the LSI that is theoretically based on dialectic interdependence of variables and on situational variability.
BIODGRAPHICAL SKETCH

Ronald Fry came to M.I.T.'s Sloan School of Management in 1969. Before that he had been an engineering graduate of the University of California at Los Angeles, and had worked at Hughes Aircraft Company. Since receiving his S.M. Degree in Management in 1971 and entering the doctoral program, Ron has been an Instructor in the Organization Studies Group and a Research Associate where his responsibilities included project coordinator in the Educational Materials for Health Management Project.


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