

APPLICATION OF KOLB'S LEARNING THEORY AS A FRAMEWORK FOR TEACHING UNIVERSAL DESIGN

Louise Jones

Abstract

The concept of Universal Design considers the environmental needs of people of all ages and abilities. This concept is much broader than the typical approach which emphasizes design for special populations or for compliance with barrier free building codes, the Fair Housing Act, or the Americans with Disabilities Act. If the designed environment is to meet the needs of all users and accommodate changes over their lifespans, design students need to accept Universal Design as a personal design philosophy that is the underlying premise for all of their design work. Kolb's theory of experiential learning and inventory of learning styles was used as a conceptual framework to develop studio activities that encouraged interior design students to adopt Universal Design as an underlying premise for their own design work. Analysis of the pre/post test results and student commentary indicates there was a change in both knowledge of and attitude toward the concept of Universal Design. Although there is no way to be certain that this change is a direct result of developing the studio activities using Kolb's theory of experiential learning and inventory of learning styles, the results of this pilot project suggest that this pedagogy has potential and is worthy of additional study.

Introduction

The concept of Universal Design considers the environmental needs of people of all ages and abilities. This concept is much broader than the typical approach, which emphasizes design for special populations or for compliance with barrier free building codes, the Fair Housing Act, or the Americans with Disabilities Act. To accommodate human diversity through environmental design, design students need to accept Univer-

Louise Jones is an Associate Professor in the Department of Human, Environmental and Consumer Resources at Eastern Michigan University, Ypsilanti, MI.

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sal Design as a personal design philosophy that should be the underlying premise for all of their design work.

Demographics

Increasingly, design in the United States attempts to accommodate people with disabilities. Most municipalities have building codes that incorporate barrier-free design regulations for public spaces (often based on criteria developed by the American National Standards Institute, i.e., ANSI Standard A117.1, 1986), and federal buildings must comply with the Uniform Federal Accessibility Standards (UFAS). The Fair Housing Act (FHA), as amended in 1991, expanded the scope of concern and addressed the residential needs of people with disabilities living in multi-family dwelling units. The Americans with Disabilities Act (ADA) of 1990 is the most encompassing, in that it is a civil rights law that prohibits discrimination against people with disabilities. This is important legislation for the 49 million Americans who are permanently disabled (McNeal, 1993), but anyone living long enough will, at some point, experience a disability, e.g., a problem with walking, seeing, or hearing. “We are not only different from each other, we are also different individually from who we were yesterday and who we will be tomorrow” (Mueller, 1993).

As they get older and begin to experience chronic health problems, elderly people often need many of the environmental accommodations typically provided for people who are disabled. This is an important consideration for those responsible for the design of both residential and public buildings, because the elderly make up an increasingly large segment of the population. Data prepared by the U.S. Bureau of Census (1993) show that in 1900 there were 3 million Americans aged 65 or older (1 in 25 Americans), comprising only 4% of the population. By the 1990 census, 12.6% of the population, or 31.3 million people (or 1 in 8 Americans) were aged 65 or older. By the year 2050, the numbers are projected to be 67 million, or 22% of the population (1 in 5 Americans).

Universal Design

Universal Design goes beyond the limiting design parameters of attending to a special population, such as those who are disabled or elderly, and treats everyone within the context of normal expectations. “Able-bodied, six-foot adult males in the prime of their lives are not the majority of people in this country — never have been and never will be” (Mace, 1993). Universal design is a change in attitude, a way of rethinking who constitutes the “user”.

Universal Design addresses the practice of designing for the “average” person, who has traditionally been the standard of design, by recognizing and accommodating the vast array of human diversity. Considering the differing needs of all users universal design acknowledges both the centrality of diversity and its societal pervasiveness (Jones, Sekulski, & Pastalan, 1994).

Research Problem

Given that Universal Design is more than barrier free codes or the Americans with Disabilities Act Accessibility Guidelines (ADAAG), how can an understanding of this concept be integrated into the design studio experience? If the concept of Universal Design is to become the standard, students must accept it as the underlying premise for the design of both public and residential spaces. But because students have diverse learning styles, how can this diversity be accommodated in the studio setting to bring about a change in both knowledge and attitude?

Literature Review

The design studio is inherently an experiential learning environment - students learn by doing. David Kolb (1984) described experiential learning as a holistic integrative perspective on learning that combined experience, perception, cognition, and behavior. He developed an experiential learning theory (1984) and an inventory of learning styles (1985) that can provide a framework for the development of studio assignments that will facilitate students' learning.

Kolb's work does not stand in isolation, but instead draws upon a large body of research on experiential learning and human development. Its foundations are eclectic, rooted in a whole range of settings and movements in such diverse disciplines as philosophy, psychology, sociology, and education. Although an in-depth analysis of the development of experiential learning is beyond the scope of this paper, an abbreviated examination will provide the groundwork for Kolb's work. (For a more in-depth discussion see Kraft's *The Theory of Experiential Learning*.)

Aristotle, the father of science, believed "action experience seems in no respect inferior to art, and men of experience succeed even better than those who have theory without experience" (1948, p. 689). Aristotle's emphasis on empirical learning (i.e., knowing through experience) stood in direct contrast to Plato's contention that knowledge comes about through a reasoning process. Twenty-four hundred years after their deaths, the debate between rationalists, led by Plato, and empiricists, led by Aristotle, continues.

Throughout history, formal schooling developed a strong rational orientation, with a marked preference for deductive reasoning taught through lectures and recitations. However by the early nineteenth century, the pressures of "modern" society forced the inclusion of more practical forms of education, such as engineering, agriculture, and architecture. The liberal arts, on the other hand, were still dominated by the rational and theoretical approach, with few connections to experiential modes of learning.

Early in the twentieth century, John Dewey, building upon the philosophical treatises of Locke, Hume, and Nietzsche, (which supported empirical, experiential ideals) tied the empiricism to educational experience. His premise that "all genuine education comes about through experience" (1938, p. 25) was the basic treatise of the Progressive Education Movement. Although Dewey supported an "organic connection between education and personal experience" (1938, p. 26), he did not equate education and experience. He believed that any growth through experience must create the conditions for future growth, i.e., experiential learning requires an educational continuum of

opportunities. Continuity and interaction (the subjective evaluation of the experience) were seen as the longitudinal and lateral aspects of experience.

Dewey's ideas were never put into widespread practice in the United States, but in other parts of the world the connections between experience and education were the basis for a new model of education. Mao Tse-Tung, who believed "all genuine knowledge originates in direct experience . . . whoever wants to know a thing has no way of doing so except by coming into contact with it" (1968, p. 7), developed and implemented a model of experiential education that affected the lives of one-fourth of the world's population (i.e., the Chinese population) and was copied by numerous third-world countries as the basis for their educational systems.

Developmental psychologists laid the foundation for an educational psychology that supports experiential learning. Jean Piaget believed that intellectual development occurred through pertinent experiences, with the mastery of one concept after another. His model of "Stages for the Mastery of Operations" (1971) provided strong justification for a progressive movement from concrete to abstract concepts. Erik Erikson theorized eight developmental stages in *The Life Cycle of Man* (1963) moving from infancy to senescence. The later stages, when autonomy, initiative, and industry are addressed, are seen as critical components of many experiential learning programs.

Educational psychologists have made significant additions to learning theory. Benjamine Bloom (1956) generated a taxonomy of educational objectives that classify learning into three domains: the cognitive domain (knowledge), the psychomotor domain (skill), and the affective domain (attitude). William Perry (1970) developed a progressive schema for college students' intellectual development, a sequence of positions through which students view the world of knowledge, truth, and value. Dualism, a right/wrong perspective, gives way to multiplicity, with diverse definitions of truth and no absolutes. Ultimately truth is seen as contextual, whereas the meaning of a phenomenon is embedded in the context and perspective from which it is viewed. Jerome Bruner (1966), an influential learning theorist, developed a theory of instruction that makes students participants in the learning process, not just receptacles into which knowledge is poured. In his influential book, *Toward a Theory of Instruction*, he proposed using problem-solving methods, rather than the more traditional lecture, recitation, and rote memorization techniques.

James Coleman (1974), a sociologist by training, has become to contemporary experiential education what John Dewey was to progressive education (Kraft, n.d.). In his monograph comparing classroom and experiential learning, he described classroom learning as assimilation, with most of the learning proceeding through instruction, as opposed to the experiential process in which learning proceeds through experiencing the consequences of action. Assimilation uses a symbolic medium for transmitting information, whereas in experiential learning the information is generated through completion of a sequence of steps in the process. Paulo Friere (1975), a Brazilian educational philosopher who has played a major role in the development of educational practice, stressed the dialectic of action and reflection as the two inescapable aspects of experiential education.

Kolb's Theory of Experiential Learning

Kolb used this eclectic body of previous theories to develop a model for experiential education comprised of an experiential learning theory (1984) and an inventory of learning styles (1985). He described experiential learning as a four-stage cycle encompassing four learning modes: *concrete experience*, *reflective observations*, *abstract conceptualization*, and *active experimentation*. For Kolb, experiential learning begins in experience, proceeds through reflection to conceptualization, and culminates in the application of generalizations to actual situations.

Kolb perceived learning as having two dimensions, *prehending* (grasping or acquiring information) and *transforming* (processing that information). The prehending dimension ranges from concrete experience to abstract conceptualization. The transforming dimension ranges from reflective observation to active experimentation. Kolb's experiential learning theory (1984) suggested that learning occurs as the student moves through repetitive cycles from concrete experience, to reflective observation, through abstract conceptualization, and finally to active experimentation. Students have a concrete experience, are fully involved in it and then reflect on that experience from different perspectives. From these reflective observations they engage in abstract conceptualization, and develop generalizations that help them integrate their observations into existing theories or principles. Finally, they use these generalizations as guidelines for further active experimentation in more complex situations (Murrell & Claxton, 1987).

Kolb's theory can also be visualized as the intersection of the two dimensions (see Figure 1). The vertical axis is prehending (or grasping), with two dialectical adaptive modes: concrete experience and abstract conceptualization. The concrete experience

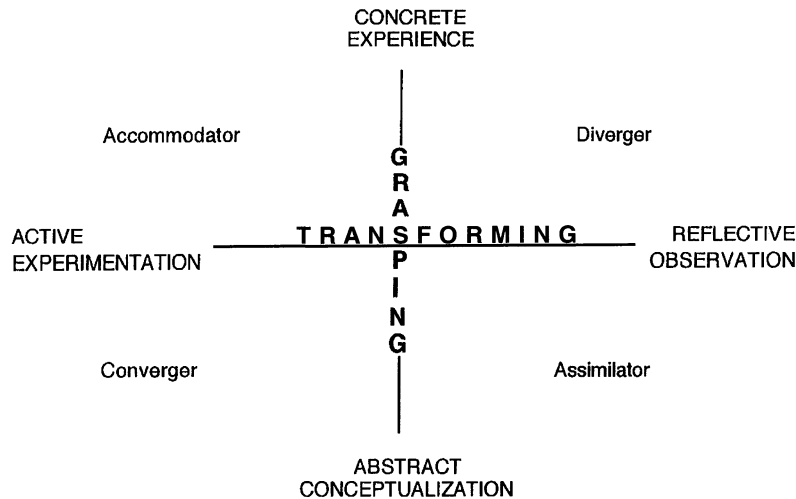


Figure 1. Kolb's (1984) Experiential Learning Model and Learning Styles Inventory

draws more on the right brain, with a holistic perspective and an emphasis on feeling. The abstract conceptualization experience draws more on the left brain where the emphasis is more analytical, making use of conceptual interpretation and symbolic representation. The horizontal axis is transforming, also with two dialectical adaptive modes: reflective observation and active experimentation. In reflective observation, the emphasis is on the experience itself, rather than on manipulation or change, which is the emphasis in active experimentation (Kolb, 1984).

Learning Style

Learning style is a broad term that can include cognitive, affective, and physiological components. It does not include ability or intelligence, nor is any one learning style superior to another style. Learning style tends to be stable throughout life, but can change as circumstances demand; learners may adapt their learning style in order to be successful when the learning environment is not a good match for their learning preferences. There are multiple theories of learning styles, each with its own strengths and weaknesses (Keefe, 1988).

Kolb used his model of experiential learning to develop a learning style inventory (see Figure 1) that identifies four learning preferences: divergers, assimilators, convergers, and accommodators. *Divergers* prefer to learn through concrete experience and transform knowledge through reflective observation. Named 'divergers' because of their ability to generate diverse ideas, they like to view situations from different perspectives and then weave the relationships into a meaningful whole. *Assimilators* prefer to learn through abstract conceptualization and transform knowledge through reflective observation. Named 'assimilators' because of their ability to assimilate diverse data into an integrated whole, their strength is in creating theoretical models where their primary interest is in abstract concept and not in application. *Convergers* prefer to learn through abstract conceptualization and transform knowledge through active experimentation. Named 'convergers' because of their tendency to converge on one 'correct' answer, they are the opposite of divergers. *Accommodators* prefer to learn through concrete experience and transform knowledge through active experimentation. Named 'accommodators' because they do well in situations where they must adapt to new circumstances, they are the risk takers who like to focus on new experiences, the opposite of assimilators (Claxton & Murrell, 1987).

When students are provided opportunities to be systematically engaged in all four modes, emphasis is placed on the development of competency in all modes rather than on accentuating any preferred mode. Thus the experiential learning cycle becomes a model of human development as the student becomes increasingly capable of taking in information both concretely and abstractly and of processing or transforming it both reflectively and actively (Davis, Murrell, & Davis, 1988).

Methodology

The author was one recipient of a Universal Design Education Project (UDEP) grant¹ funded to introduce Universal Design concepts into architectural, industrial, in-

terior, and landscape design curricula. The objective of this part of the UDEP project was to introduce seniors in the interior design program at Eastern Michigan University to Universal Design concepts. Kolb's theory of experiential learning and his inventory of learning styles were used as a framework to develop studio activities to introduce Universal Design concepts and to encourage students to adopt Universal Design as an underlying premise for their design work. A pre/post test design was used to evaluate changes in knowledge and attitude.

Studio Assignment

Senior interior design students were invited by a non-profit agency to develop a design proposal for the adaptive reuse of a vacant hotel into a housing and activities center for senior citizens².

The Allene Hotel in downtown Ann Arbor, Michigan, was built in the 1840s. Although the original building was razed in 1963, a hotel had been in operation on the site until 1990 when the owner declared bankruptcy, and the furnishings, fixtures, and equipment were sold. The vacant 11-story, 145,000-square-foot building was zoned to permit residential, commercial, and retail use. The client's intent for adaptive reuse of the Ann Arbor Inn was to provide office space; an indoor, year-round park; retail spaces; classrooms and offices for the local community college's outreach program; senior co-op apartments; management offices and resident activity rooms; indoor pool and physical fitness center; and a restaurant for both residents and the general public.

Each student developed an apartment design (efficiency, one bedroom, two bedroom, or double master bedroom unit). The base plan for the apartment was developed to meet Universal Design guidelines; after which modifications were developed for different user groups. To provide opportunities for cooperative learning experiences, students worked as teams to complete proposals for the public space designs. They incorporated Universal Design guidelines in the design of the public spaces in order to consider the needs of users of all ages and abilities.

Process

Students researched user needs related to disability issues and advanced age. To avoid duplication of efforts, to save time, and to learn to work together, students were divided into research teams. Each team was assigned to one of the following user groups (selected to represent the diverse groups that could reasonably be expected to use this facility)

- Individuals with hearing impairments;
- Individuals with visual impairments;
- Individuals with physical frailty;
- Individuals with temporary or permanent mobility impairments (cane, crutches, walker, wheelchair, electric cart, etc.);
- Individuals with grip/dexterity/manipulation limitations;
- Individuals who fell within the anthropometric extremes (greater than the 95th percentile or less than the 5th percentile).

In addition to literature reviews, student research included interviews with elderly people and members of the user groups; interviews with directors of senior housing and senior centers; visits to the local Center for Independent Living; attendance at a full-day workshop on ADA by Cynthia Leibrock (author of *Beautiful Barrier-Free*); interviews with agencies interested in the Ann Arbor Inn renovation; and participant observation at senior centers.

Faculty³ identified two members of each user group who were willing to work with the students (identified hereafter as the *consultant*). Student teams used a game/simulation, *A DAY'S JOURNEY THROUGH LIFE*[®], to more fully understand the consultant's daily interactions with the designed environment⁴. Game play provided an opportunity for students to see the world through the consultants' eyes. (For a more complete description of the game/simulation see Jones et al., 1994.)

Each team summarized their findings in a one-page handout for their classmates to use as a 'Design Guideline Reference Sheet' during the design development of the Ann Arbor Inn renovation. The handout factually described the disabilities (e.g., legal definitions of blindness and visual deficiencies), identified the most common design concerns, and included an annotated bibliography of source material.

Through research and interactive programming experiences (participant observation, interviews, and game play), students became knowledgeable about and developed an empathy for each particular user group being investigated. Each team member then served as an advocate for that user group for the duration of the semester. This advocacy included working with classmates to resolve design concerns and critiquing design proposals as to their appropriateness for the particular user group.

Each student developed an apartment design that was appropriate for senior housing. In addition to meeting the Fair Housing Accessibility Guidelines and Ann Arbor building code requirements, the base plan for the apartment was developed to meet Universal Design guidelines, after which modifications were developed for different user groups. For example, one student's design included the following:

Universal Design: All doorways in the unit were specified as having a 32" minimum opening to facilitate moving furniture and for access for emergency gurney (as well as for individuals using walkers, electric carts, or wheelchairs). Lever door handles made it easier for residents who had their arms full of grocery bags or laundry, and met the needs of users who had dexterity/manipulation/grip problems. Electrical outlets were raised from 15" above the finished floor to 24", switches were placed at 48" above the finished floor, and tub/shower controls were moved off center to facilitate access by all users.

Modification: The unit was pre-wired so that a visual emergency alarm could be installed if the resident was hearing impaired. Kitchen cabinets were installed using a bracket system that provided for height adjustment and removal of individual cabinets. This height adjustment accommodated the needs of residents who found the standard height difficult to use or of residents who used a wheelchair or electric cart and needed base cabinets removed to provide access

to appliances, countertops, and wall cabinets. Bathroom walls were reinforced to facilitate the future installation of grab bars.

To maximize opportunities for cooperative learning, and to complete the project during the allocated time, students worked as design teams (4-5 students each) to complete the public space proposals. Each team was assigned a portion of the building, e.g., 11th floor restaurant, ground level retail shops, lobby and vertical circulation, 2nd floor educational center. In addition to meeting ADAAG and barrier-free code requirements, students were required to incorporate Universal Design guidelines in developing the space plans, the interior architecture and detailing, the finish material and furnishings selection/specification, and the lighting design in order to consider the needs of users of all ages and abilities.

The senior studio was team-taught by the interior design faculty⁵ in an environment that modeled a design project students might encounter after graduation. The project was accepted for development, design teams were assigned, and the “designers” worked through the problem with frequent critiques by the “project supervisor” and “consultants” selected for their expertise in a particular area.

Faculty and peer critiques of two-dimensional and three-dimensional design exploration (including floorplans, sketches, and white models) were integral components of studio activity. Student advocates evaluated the appropriateness of design proposals for specific user groups. As students came to understand the complexity of designing for people of all ages and abilities, frequent revisions were necessary. The UDEP representative for the project (Polly Welch, AIA, Professor of Architecture at the University of Oregon) and the consultants were invited to the mid-term critique to provide additional input on integration of Universal Design guidelines.

The semester’s work concluded with a formal presentation. Among the invited guests were the user group consultants, University administrators, the developer, and other public representatives with a vested interest in the adaptive reuse of The Ann Arbor Inn, such as members of the Housing Policy Board, the Downtown Development Authority, parks and recreation department personnel, community college administrators, city council members, and reporters from the local newspapers.

Discussion

During pre-semester planning, David Kolb’s experiential learning theory was used as a framework to develop studio assignments that not only considered dimensions of learning (i.e., prehension and transformation) but also accommodated students’ diverse learning styles, as defined by Kolb’s model (i.e., divergers, assimilators, convergers, and accommodators).

Divergers, who prefer to learn through concrete experiences and reflective observation, had an opportunity for game play and subsequent debriefing during class discussion to emphasize the various viewpoints.

Assimilators, who prefer to learn through abstract conceptualization and reflective observation, had an opportunity for library research and subsequent de-

briefing and development of “Design Guideline Reference Sheets” for use in design development.

Convergers, who prefer to learn through abstract conceptualization and active experimentation, had an opportunity use library research to develop Design Guideline Reference Sheets and subsequently use them to develop a “correct” design for the apartment.

Accommodators, who prefer to learn through concrete experience and active experimentation, had an opportunity to play the game with the consultant and subsequently develop a design proposal for the apartment.

Since all students participated in all activities, students found that some assignments were relatively easy (i.e., they felt comfortable) and other assignments challenged their ability to engage in less comfortable learning modes. Emphasis was placed on learning to become competent in all four learning modes, rather than refinement of the preferred mode.

Kolb suggests that individuals learn as they move through repetitive cycles of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Students had a *concrete experience* (game play with the consultants), then reflected on the experience from different perspectives (game play debriefing during studio class). From these *reflective observations* they engaged in *abstract conceptualization* (development of Design Guideline Reference Sheets). Finally, they used these guidelines or generalizations for further *active experimentation* in more complex situations (the designs for the apartments). The cycle was then repeated, i.e., concrete experience — design for apartment; reflective observation — reaction to class critiques by advocates for user groups; abstract generalizations — development of Universal Design criteria that could be used in future design work; active experimentation — the design of the public spaces using Universal Design criteria. Theoretically, learning should have occurred as students moved through repetitive cycles of prehension and transformation; their learning was tested using a pre/post test design in a small pilot study.

On the first day of class, students were asked to complete a brief questionnaire, the pre-test; on the last day of class they were given a similar questionnaire, the post-test⁶. They were asked: “Are you familiar with the concept of Universal Design? If YES, how would you describe it to a colleague? Do you believe Universal Design will impact you professionally after graduation? If YES, how?” The same set of questions was asked regarding ADA. Of the 20 students who completed the class, there were 16 usable questionnaires, an 80% response rate (2 students did not complete the pre-test; 2 students did not complete the post-test; participation was voluntary to comply with human subjects review requirements). The results are shown in Table 1.

As seniors in the interior design program, the students had worked with ADAAG in previous design projects. It was not surprising that in the pre-test all but one student knew ADA would have an impact on their professional practice after graduation. In the post-test, five students chose not to answer the question that asked them to define ADA,

Table 1. Students' Perceptions of ADA and Universal Design (n=16)

	PRE-TEST		POST-TEST	
	YES %	NO %	YES %	NO %
Could correctly define ADA	75	25	69	31
Believed ADA would impact them professionally after graduation	94	6	100	0
Could correctly define Universal Design	31	69	94	6
Believed UD would impact them professionally after graduation	25	75	100	0

Note: Due to the nature of the question no response was considered a "NO".

although three of the five indicated that they were familiar with ADA; this omission resulted in a drop in the post-test percentage of students correctly defining ADA.

The Universal Design questions present a different story. On the pre-test only five students could accurately define Universal Design. Only four students understood the impact Universal Design could have on their professional practice. At the end of the term essentially all students could define Universal Design and believed it would influence their professional design practice (one student said she/he were familiar with Universal Design but skipped the request to define it).

The responses to the open-ended questions were evaluated for changes in student attitudes. The responses suggest that many students recognized the importance of incorporating Universal Design concepts and have adopted Universal Design as the underlying premise for their design work.

How do you think Universal Design will impact you professionally?

It makes me as a designer aware that design is for everyone and every ability.

(seven similar responses)

How has your understanding of the relationship between user needs and the physical environment changed this semester?

Became more aware of what actually limits ones freedom of choice.

(eight similar responses)

What single 'most important thing' did you learn this semester?

To design for everyone, not just the 'average' person.

(seven similar responses)

The responses to the question, "What aspect of the course most contributed to your learning that 'most important thing' mentioned above?", suggest that the assumption

DIVERGERSConcrete Experience

consultants (4)
game play
hands on experience

Reflectant Observation

programming process
developing reference sheets
designing for everyone, not
just 'average individual'

ASSIMILATORSAbstract Conceptualization

research (2)
handouts
Cindy Leibrock's lecture (2)

Reflectant Observation

programming process
developing reference sheets
designing for everyone, not
just 'average individual'

CONVERGERSAbstract Conceptualization

research (2)
handouts
Cindy Leibrock's lecture (2)

Active Experimentation

designing
UD for the apartment
using ADA and codes
professor's persistence

ACCOMODATORSConcrete Experience

consultants (4)
game play
hands on experience

Active Experimentation

designing
Universal Design for the apartment
using ADA and codes
professor's persistence

Figure 2. Responses to question "What aspect of course most contributed to your learning?" categorized by learning preference modes

that there were multiple learning styles represented in the student population was correct. Responses fell into categories that correspond with Kolb's four learning preferences: divergers, assimilators, convergers, and accommodators (See Figure 2).

Both the quantitative and the qualitative analyses suggest that there was a change in both knowledge of and attitude toward Universal Design. Although there is no way to be certain that this change is a direct result of having developed the studio activities using Kolb's theory of experiential learning and inventory of learning styles as a framework, the results of this pilot project suggest that this pedagogy has potential and is worthy of additional study. Future work could compare the use of Kolb's theories with the use of other learning theories (e.g., learning styles as defined by the Myers Briggs inventory) to structure the studio experiences. Use of a control group, for which the

structure for studio activities is not supported by a theoretical construct, would lend additional credence to the findings.

Conclusion

Universal Design is a relatively new response to problems of accessibility. It is important to introduce students to the concept and to encourage them to accept the premise before graduation if Universal Design is to become the dominant design philosophy in the United States. It is easier and more efficient to influence a student's design process because students are philosophically more malleable than many design practitioners who may be more resistant to change and more difficult to reach.

It was beyond the scope of this study to compare the use of Kolb's theory with the use of other learning theories to structure the studio experience; therefore no statement can be made as to the comparative effectiveness of using Kolb's theory as a comprehensive model for development of teaching/learning activities. However, the results of the pilot study do suggest that students' skills in prehending (or acquiring) information both concretely and abstractly and processing (or transforming) it both reflectively and actively were enhanced. Students not only became aware of Universal Design, they also understood it, could use it in their projects, and many internalized it as the underlying premise for their design work.

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Footnotes

¹Lee Pastalan, Ron Sekulski, and Louise Jones, research associates of the Environmental Design for Aging Research Group at The University of Michigan, were awarded a UDEP grant. The UDEP was coordinated by Adaptive Environments, Inc. in cooperation with the Center for Accessible Housing, with funding by National Endowment for the Arts, U.S. Department of Justice, NEC Foundation, J.M. Foundation, and NYNEX Foundation.

²Abe Kadushin, principal of Kudushin Associates Architects and Planners, developed the original proposal at the request of the Ann Arbor Mutual Housing Association and was the contact person for the project.

³The UDEP grant activities included students from both the University of Michigan (working with Ron Sekulski) and students from Eastern Michigan University (working with Louise Jones) for a better understanding of the allied disciplines. Student teams for the game play were comprised of students from both universities; the mid-term critique and final presentation were also joint activities.

Jones

⁴Ron Sekulski and Louise Jones developed A DAY'S JOURNEY THROUGH LIFE[©] using a generic game/simulation developed by Leon A. Pastalan, Louise Jones, Benyamin Schwarz, Ronald Sekulski, and Laura Struble of the Environmental Design for Aging Research Group (EDARG) at The University of Michigan.

⁵Dr. Deb DeLaski-Smith supervised selection and specification of materials, surface finishes, and furnishings; Dr. Louise Jones supervised design exploration and development including incorporation of Universal Design considerations as well as compliance with barrier-free building codes and ADAGG; Abe Kadushin supervised time management plans and adaptive reuse considerations, including construction, HVAC, electrical and plumbing; Dr. Virginia North supervised programming and concept development, lighting design, and design presentation.

⁶William McKeachy of The University of Michigan's Center for Research on Learning and Teaching assisted in the development of the pre- and post-tests.