Are There Lasting Effects of a Schema Based Learning System in Interior Design Studio?

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Are There Lasting Effects of a Schema Based Learning System in Interior Design Studio?

Abstract
Gallini (1989) argues that, “the ability to combine a collection of problems into a meaningful representation, or schema facilitates learning” (p. 244). In a previous study, it was found that introducing a schema-based learning system in the design studio assisted novice designers in a structured, purposeful process, where they began to see patterns of information and use these patterns to develop and refine their design solutions. Their design solutions proved to be significantly better than the other students who did not utilize the instructional interventions. But, does this instructional intervention have any lasting effects with this same group of students? Do these skills transfer to new or novel tasks after a period of time? The aim of this study is to measure the lasting effects of this learning tool by following this group of students through a new set of transfer tasks approximately one year after the original instructional intervention. Like the previous year study, the effectiveness characteristics were examined from four main areas of a design project: 1) organization of information, 2) categorization of information, 3) application of theory, and 4) overall design. The following research questions were addressed: 1. What are the lasting effects of the schema-based learning tools after one year from the initial implementation of the instructional intervention? Or, what are the problem solving transfer effects of the instructional intervention? 2. Do students, who use these schema-based learning tools, develop projects that are more organized, categorized, more theoretically-based, and have better overall designs, than students who do not use such learning tools?

Disciplines
Art Education | Educational Methods | Higher Education | Interior Architecture

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Are There Lasting Effects of a Schema-based Learning System in the Interior Design Studio?

Lori Brunner, Iowa State University

Purpose

Gallini (1989) argues that, “the ability to combine a collection of problems into a meaningful representation, or schema facilitates learning” (p. 244). In a previous study, it was found that introducing a schema-based learning system in the design studio assisted novice designers in a structured, purposeful process, where they began to see patterns of information and use these patterns to develop and refine their design solutions. Their design solutions proved to be significantly better than the other students who did not utilize the instructional interventions. But, does this instructional intervention have any lasting effects with this same group of students? Do these skills transfer to new or novel tasks after a period of time? The aim of this study is to measure the lasting effects of this learning tool by following this group of students through a new set of transfer tasks approximately one year after the original instructional intervention. Like the previous year study, the effectiveness characteristics were examined from four main areas of a design project: 1) organization of information, 2) categorization of information, 3) application of theory, and 4) overall design. The following research questions were addressed:

1. What are the lasting effects of the schema-based learning tools after one year from the initial implementation of the instructional intervention? Or, what are the problem solving transfer effects of the instructional intervention?
2. Do students, who use these schema-based learning tools, develop projects that are more organized, categorized, more theoretically-based, and have better overall designs, than students who do not use such learning tools?

Framework

This study uses schema theory (ST), viewed by Derry (1996) as a version of the information processing theory. ST and information processing psychologists believe long-term memory stores previously learned schemas, and working memory represents a person’s extent of immediate attention. Thinking and learning take place within working memory, where prior knowledge schemata are activated in response to the environmental

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1 According the constructivist interpretation of the information-processing model, mental processing involves an active search for understanding, where incoming experience is reorganized and integrated with existing knowledge. Mayer (1996) distinguishes three basic processes in active learning: 1) selecting relevant incoming experiences, 2) organizing them into a coherent representation, and 3) integrating them with existing knowledge. In this view, processing is a coordinated collection aimed at making sense out of incoming experiences.
input. This then provides the context for interpreting experiences and assimilating new knowledge.

This study also uses Royer’s (1979) Cognitive Theory of Transfer, emerging, like ST, from information processing theories. Royer argues that the critical aspect of transfer does not revolve around shared features in the stimulus environment, but rather involves the process of retrieval or the likelihood that transfer of learning will occur, which is determined by the probability of retrieving relevant prior learning during the search process.

Review of Literature

Schema Theory and Problem Solving Transfer

The importance of ST in design studio education is highlighted by Chan’s (1990) statement that “the ability of organizing and applying schemata determines a designer’s ability” (p. 78). Schema describes the organization of information in human memory in terms of a network believed to be held among concepts (Rumelhart & Ortony, 1977). Schema-driven strategies involve the use of schemata in performing complex cognitive tasks, such as: a) Categorizing information by concept domains, b) Developing conceptual hierarchies for information that is processed, and c) Forming relationships between concepts.

Phye (2005) acknowledges “Problem Solving Transfer” as a seminal article on transfer, where Mayer and Wittrock (1996, p. 48) define transfer as the process “when a person’s prior experience and knowledge affects learning or problem solving in a new situation. Transfer, then, refers to the effect of knowledge that was learning in a previous situation (task A) on learning or performance in a new situation (task B).”

Methodology

This study was a quasi-experimental design—a within group and a between group analysis. The within group analysis followed through to the next academic year 11 of the original group of 30 pre-interior design students who had been exposed to the instructional intervention. As a result of the selective admissions review process, the 11 students were admitted to the program for fall 2004 and were the subjects in the within group analysis². Here one is interested in the gain score or difference between 2005 and 2004 scores. This group of 11 subjects also served as the experimental group for the between group analysis in the students’ sophomore year. The second part of the study—the between group analysis, compares the experimental group to the no treatment control group, or the other 26 students in the sophomore class not involved in the 2004 study. This control group had received traditional instructional materials and resources.

² The individual student acted as their own control, diminishing the individual difference effects of the students.
Performance assessments were conducted after the 2004 Freshmen Project and after the 2005 Sophomore Project. The duration of each project was approximately four weeks. The no-treatment control group encountered the traditional, studio instruction—one-on-one student-instructor interaction each class period and exposure to the associated reading and lecture materials. The experimental group also, encountered the traditional studio instruction but was also given one of two variations of an instructional intervention: 1) analysis cards, or 2) a combination of analysis cards and a customized database learning tool.

Analysis Cards—Instructional Intervention I

The Analysis Card Technique (Pena, 1977) is a method of collecting, recording, and organizing information in small units or cards, where each card holds a single idea or piece of data (or schemata). A card includes both annotations and graphics to depict a particular idea as shown in Figure 1 and Figure 2. A weakness of this method is that it can be difficult to find relationships or links between various cards and categories. A database assists by dynamically giving the learner an expert’s framework for encoding, organizing, and retrieving information or schemata.

Database/Analysis Card Model—Instructional Intervention II

A customized database environment was developed, emphasizing the problem solving process. The database provides an expert-like structure by including categories or ways to organize, sort, and build relationships between various cards into meaningful patterns of information. Each analysis card (or database record) is associated with one stage of the problem solving model, as well as to one or more aspects of the design project. In the 2004 freshmen study, these aspects were H.O.P.P.S. (Health Safety Welfare, Operational, Psychological, Physical, or Setting). Figure 3 depicts some of the screens of this database tool.

Measurement Instruments

Two forms of assessment were utilized to measure student performance and knowledge at two points in time (2004 freshmen project, and 2005 sophomore project). First, the Design Review Panel (DRP) measurement instrument (figure 4) was administered to evaluate students’ final design solutions. This instrument included topics of organization, categorization, linkages of information, theory usage, and overall design success. Second, a five-question multiple-choice quiz was given, which covered definitions of the P.A.Th.Way.S. design paradigm. Because of the nature of the research

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3 A method that has been developed to rate how well a student performs complex activities such as playing an instrument, presenting material orally, and doing and writing research (Shafer, 1997).

4 According to Phye (2004), the demonstration of change is not left to speculation. Change can only be determined by measuring the behavior at two points in time—typically, prior to and following instruction.

5 A systems definition of interior design, developed by Fred Malven (2003).
design (a within and a between group analysis), data for the within group participants included 2004 and 2005 project data. Data for the between group participants included only 2005 project data (sophomore project).

Data Analysis

The data were analyzed using ANOVA, independent samples t-test, and paired samples t-test inferential statistics. The analyses looked at differences between the two groups as 2005 sophomores (ANOVA and independent samples t-test), and within the experimental group’s performance between 2004 Freshmen Project and 2005 Sophomore Project (paired samples t-test).

Results

Results of the within-group analysis from the paired samples t-test revealed significant gains in their performances (2004 to 2005 projects) in categorizing, organizing, and linking of information in their design projects. In addition, this group also showed significant gains in their verbal presentation scores. Other DRP questions, including theory usage, overall design, and boards and model proved statistically insignificant. Results of the between group analysis from the ANOVA and independent samples t-test did not show any significant differences between the two groups of sophomores. Results from the five question quiz also showed no significant differences in the within-group and between group analyses. Interestingly, 11 of the 38 students admitted into the professional interior design program after the freshmen year, were exposed to the schema-based learning tools.

Conclusions

Transfer effects were found in the areas of organization, categorization, and linkages or relationships of information in the students’ design projects. The importance of schema theory in design studio education is highlighted by Chan’s (1990) statement that “the ability of organizing and applying schemata determines a designer’s ability” (p. 78).

While no differences were found between the control and experimental group of sophomores, there could be a number of reasons for this. Without directed practice, as Phye (1997) urges, students will not form the habits and strategies found in experts’ problem-solving methods. Second year students may very well still need the expert scaffolding as found in the schema-based learning tools of analysis cards and the customized database system. In a previous study, Brunner (2005) found significant differences between the control and experimental groups in all of the DRP survey questions. With such significant results obtained from this structured schema-based learning system, design instruction and instructors should take notice—the power of such instructional tools, and the temporary nature of these knowledge and skills if not practiced and reflected upon throughout a student’s program of study.
References


High visibility intersection in Downtown.

Floor surface

Zone the building into 2 kinds of zones - public & more intimate zones. Make a clearly marked edge between the two. Do this through the use of flooring materials.

-Alexander
Figure 1. Analysis card examples

Analysis (of existing conditions)

Way (Concept)

Solution
Figure 2. Analysis card examples of P.A.Th.Way.S.

Opening screen of the database organizer.

This screen highlights all of the reports a student can generate from their constructed database.
**Figure 3.** Screens of the database tool.

<table>
<thead>
<tr>
<th>CATEGORIZATION / ORGANIZATION / LINKAGES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>C.1. Well-organized—The student presents a well-organized argument or rationale for their design decisions.</td>
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<td>C.2. Logical categorization—The student categorizes information into a logical or meaningful framework and reveals a strong level of detail.</td>
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<td>C.3. Strong technical/factual linkages—The student demonstrates strong linkages or connections between information in the various design stages (Problem ID, Analysis, Theory, Way/Concept, and Solution).</td>
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<table>
<thead>
<tr>
<th>THEORY / RESEARCH</th>
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<th>5</th>
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</thead>
<tbody>
<tr>
<td>T.1. Connection to theory—Theory is introduced and applied to design solutions. Solution is strongly supported by research (lecture material, readings, etc.).</td>
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<td>T.2. Logic usage of theory—The student uses relevant theory in appropriate and insightful ways to support their design solutions.</td>
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<td>T.3. Strength or preponderance of theory—The student exhibits a strong breadth and/or depth of theory to guide their design solutions.</td>
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<table>
<thead>
<tr>
<th>DESIGN SOLUTION</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>D.1. Verbal presentation—The verbal presentation communicates the rationale or logic of the design clearly and comprehensively.</td>
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<tr>
<td>D.2. Boards and model—The 2-D &amp; 3-D presentation materials communicate the story of the design clearly and comprehensively.</td>
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<td>D.3. Design solution overall—Overall, the design solution is strong.</td>
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**Directions:** Please circle the indicator that best describes the student’s performance on that particular item.

**Reviewer Name:** ________________________________  **Subject ID:**

**For Office Use Only**
Presentation Group #: 1 ______ 2 ______ 3 ______ 4 ______
Group CG: ______ AC: ______ AC/DB: ______
Project ID: CP: ______ VH: ______
Figure 4. Design Review Panel Survey (DRP) instrument.