Preservice Teacher Use of Learning and Instructional Design Principles

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Although many instructional technologists have suggested that teachers should be trained in using instructional design models, few studies have been conducted to determine if teachers can be successful in acquiring and applying these models. The purpose of this study was to examine preservice teacher success in acquiring and applying principles of learning and instructional design. Preservice teachers enrolled in a professional teacher preparation program were taught the essentials of learning and competency-based instruction and were required to plan a lesson using these concepts. Results indicate that most of the preservice teachers were successful in acquiring and using the principles of learning and instructional design.

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☐ In recent years, a number of authors have addressed how instructional design theory can be applied to classroom teaching (Dick & Reiser, 1989; Kerr, 1989; Martin, 1990). While Branson (1987) argues that training teachers to use instructional design models will have little impact on education, others indicate that our field can help improve education by training teachers in instructional design (Kerr, 1989; Shrock & Byrd 1987; Snelbecker, 1987). Even though many individuals believe that the instructional design community should take an active role in teacher preparation, most students of education do not receive formal training in instructional design (Kerr, 1981; Reiser, 1986; Schiffman & Gansneder, 1987).

While teachers may not learn instructional design models, they do learn models of instructional planning. According to Rosales-Dordelly and Short (1985), the most common model of instructional planning taught in college curriculum courses is Tyler's approach. Tyler (1949) suggested that teachers should plan instruction by (1) identifying goals and objectives, (2) selecting learning activities, (3) organizing learning activities, and (4) developing evaluation procedures.

Researchers have found that most teachers do not follow Tyler's "objectives-first" model. A majority of teachers begin planning by selecting instructional activities (Clark & Yinger, 1979; Macdonald, 1965; Yinger, 1980),

by considering required materials and available resources (Taylor, 1970), or by deciding on content to be covered (Zahorik, 1975).

While not as widespread as the Tyler (1949) model, other systematic approaches to instructional planning have been developed for classroom teachers (Dick & Reiser, 1989; Sullivan & Higgins, 1983). One such model is called "competency-based instruction," which includes writing objectives, designing effective instruction, and developing assessment instruments (Sullivan & Higgins, 1983). Researchers examining competency-based instruction have reported that preservice and inservice teachers are successful in learning this model (Higgins, Reiser, & Bebeau, 1976; Higgins & Sullivan, 1982; Reiser & Higgins, 1975).

It is unclear whether teachers who are trained to use systematic planning models will actually use these models. Neale, Pace, and Case (1983) found that experienced teachers who were trained to use systematic models indicated positive attitudes toward the models; however, many teachers use systematic models only informally while planning instruction or as part of mental planning. Experienced teachers believe that systematic planning models are useful for student teachers and inexperienced teachers, but even preservice teachers who are trained to use these models don't always follow them (Neale et al., 1983). In contrast, in a case study on teacher planning by Cain (1989), it was found that a preservice teacher trained to use a systematic planning model used this model extensively while planning a month-long unit of instruction.

The purpose of the current study was to examine preservice teacher success in acquiring and applying principles of learning and instructional design. The study was conducted to ensure that the preservice teachers had these skills before they left their training program. While studies have been conducted to determine preservice teacher success in learning isolated skills of systematic planning models (Higgins & Sullivan, 1982), little research has been done to examine preservice teachers' ability to use planning models such as the competency-based instruction model. In addition, few studies have examined teacher knowledge of the principles of learning that underlie instructional design models. According to Blumenfeld, Young, and Pokay (1991), knowledge of learning principles might help teachers develop comprehensive learning plans.

METHOD

Subjects

Participants in the study were 105 preservice teachers enrolled in their first semester of a professional teacher preparation program at a large southwestern university. Demographic data collected from each subject at the first class meeting indicated that: 75 females and 30 males participated in the study; the age range for the group was 20–52 years, with a median age of 27; 14 participants were Early Childhood Education majors, 51 were Elementary Education majors, 27 were Secondary Education majors, and 13 were Special Education majors.

Course Description

Instructional Goal and Objectives

A systems approach to instruction was used to develop the course. The instructional goal was for participants to use concepts and principles of learning and instructional design to plan classroom instruction. Instructional objectives for the course focused on the essentials of learning (i.e., internal processes of learning, outcomes of learning, external conditions of learning, motivation) and on competency-based instruction (i.e., instructional objectives, elements of effective instruction, criterion-referenced testing). A list of specific course objectives is given in Figures 1 and 2.

Course Materials

Materials used in the course consisted of a set of lecture notes and overhead transparencies, a participant workbook, two textbooks, two criterion-referenced tests, and a lesson plan checklist. The lecture notes contained unit objectives, procedures for recalling prior

knowledge and for establishing motivation, and information/examples directly related to the course objectives. The overhead transparencies were used to supplement the lecture by providing key information and concepts.

The participant workbook included lesson objectives, an advance organizer, a list of activities, practice exercises, and supplemental readings for each unit. The workbook also included a detailed description of requirements for the lesson plan project. In addition, participants used the textbooks *Essentials of Learning for Instruction* by Gagné and Driscoll (1988) and *Teaching for Competence* by Sullivan and Higgins (1983). Both of these textbooks were selected because they provide information and practice directly relevant to the course objectives.

Two criterion-referenced tests were developed to determine the degree to which participants had attained the information and skill objectives. One test measured attainment of

FIGURE 1 ☐ Objectives for the Essentials of Learning

- Identify the internal processes that occur at each stage of the information processing model of learning.
- Define the five major categories of learning outcomes.
- Classify examples of learning outcomes according to Gagné's taxonomy.
- Generate classroom examples of learning outcomes in each of the five major categories.
- Identify the action verbs used to describe each of the categories of learning outcomes.
- Given specific examples of learning outcomes, generate instructional activities (external conditions) that will help students acquire the outcome.
- Given examples of instructional activities, identify what learning outcome each is designed to help students learn.
- Describe each of the four components of the ARCS Model of Motivation.
- Given examples of motivational strategies, classify which component of motivation is being addressed.
- Generate motivational strategies to enhance the learning of specific outcomes and objectives.

FIGURE 2 ☐ Objectives for Competency-based Instruction

- Distinguish between instructional objectives and instructional activities.
- Identify worthwhile instructional objectives.
- Identify well-written instructional objectives.
- Write a three-part instructional objective for each of the five types of learning outcomes.
- Describe the five elements of effective instruction.
- Classify instructional examples according to Sullivan and Higgins' five elements of effective instruction.
- Identify and write appropriate instructional information for given instructional objectives.
- Identify and write appropriate student practice activities for given instructional objectives.
- Identify appropriate procedures for providing knowledge of results in given instructional situations.
- Generate a lesson plan using the five elements of effective instruction.
- Identify appropriate assessment items for given instructional objectives.
- State the three criteria for good test construction.
- Identify well-written test items and tests.
- Generate appropriate and well-written assessment items for instructional objectives.

the essentials of learning objectives, while the other assessed attainment of competency-based instruction (CBI) objectives. The test on the essentials of learning included 15 multiple-choice items, and the CBI test consisted of 25 multiple-choice items. In addition, participant performance was assessed on a lesson planning project. This project required participants to plan a lesson using principles of learning and instructional design.

For their lesson plans, participants were required to select a topic, list the learning outcomes, describe the target population, include external conditions of learning, explain how the external conditions facilitated the internal processes of learning, and select motivational strategies. Participants were also required to generate instructional objectives for the lesson, develop an assessment instrument to measure mastery of the objectives, and use elements of effective instruction as the format of the plan. According to Sullivan and Higgins (1983), the elements of an effective lesson are: (1) introduce the activity, (2) provide information, (3) provide practice, (4) provide knowledge of results, and (5) review the activity.

Upon completion of the lesson plan, one of two teaching assistants assessed the extent

FIGURE 3 ☐ Lesson Plan Checklist

Topic of the lesson (2 points)
- Can the lesson reasonably be delivered in an hour?
- Is it adequate for the specified population?

Intended learning outcome(s) of the lesson (2 points)
- Given the topic, do the outcome(s) match?
- Are they adequate given one hour for the lesson?

External conditions for learning (9 points)
- Are at least three conditions included?
- Do they relate to the intended outcomes of the lesson?
- Do they facilitate the internal process(es) of learning?

Target population of the lesson (2 points)
- Does the description adequately address all relevant student characteristics?

Instructional objectives of the lesson (9 points)
- Are at least three objectives included?
- Does each objective include the three elements of performance, condition, and standard?
- Does each objective correspond to the learning outcome(s)?

Format of the lesson plan (10 points)
- Are the five elements of effective instruction used?
- Are each of the elements appropriately addressed in the plan?

Motivational strategies (6 points)
- Are at least three strategies included?
- Do they fit into the format of the lesson?
- Does each strategy address a motivational condition?

Assessment Instrument (10 points)
- Does each item require the same performance as stated in the objective?
- Does each item provide the same conditions as stated in the objective?
- Have enough items been developed for each objective so students can meet the standard?
- Is each item clearly written and free of prompts?
- Does the instrument meet the criteria for good tests?

to which it included the above-mentioned components and assigned a score ranging from 0–50 points using the lesson planning checklist (see Figure 3). Three lesson plans were assessed by both raters to determine the reliability of this procedure. Inter-rater reliability of the assessment procedure was .95. The checklist was considered to have content validity, since it directly measured the skills taught in the course.

Procedures

Over the duration of a 16-week semester, participants were taught the principles of learning and instructional design using a combination of large group lectures and small group discussions. Each week, a 50-minute, large group lecture was presented by the instructor to provide participants with information and concepts directly related to the course objectives. For example, during the week that participants learned about the elements of effective instruction, they all attended a large group lecture. During this lecture, the instructor used a set of lecture notes to provide detailed information and examples on each of the elements of effective instruction. Overhead transparencies were used during the lecture to summarize key points.

In addition to the lectures, discussion group activities were designed to provide practice and feedback directly related to the course objectives. Each week, participants attended one of several 50-minute discussion groups that were led by a teaching assistant. During the week that participants learned about the elements of effective instruction, they were provided with practice and feedback on how to incorporate the elements into a lesson plan. Participants also were required to complete assigned readings and practice exercises in the textbooks as homework.

RESULTS

Attainment of the Essentials of Learning

Acquisition of knowledge and skills related the essentials of learning was measured using a 15-item multiple-choice test. The overall mean for the essentials of learning test was 12.4 (SD = 1.82). Results indicate that 100 out of 105 participants attained an overall score of at least 70%. Approximately a third of the participants attained 90–100% of the knowledge and skills related to the essentials of learning. The overall level of performance attained by the participants on the essentials of learning test is shown in Table 1.

Attainment of Competency-Based Instruction Skills

Attainment of competency-based instruction skills was measured using a 25-item multiple-choice test. The overall mean for the competency-based instruction test was 19.81 (SD = 3.01). The level of performance attained by the participants on the competency-based instruction test is shown in Table 2. These results indicate that 90 out of 105 participants scored 70% or better on the competency-based instruction skills test.

TABLE 1 ☐ Level of Performance on Essentials of Learning Test

Level of Performance	*Number of Participants*
90–100%	33
80–89%	40
70–79%	27
60–69%	3
0–59%	2

TABLE 2 ☐ Level of Performance on Competency-based Instruction Test

Level of Performance	*Number of Participants*
90–100%	18
80–89%	45
70–79%	27
60–69%	11
0–59%	4

Lesson Planning Performance

In addition to the two tests, the participants were required to plan a lesson using the essentials of learning and competency-based instruction. Performance on the lesson plan was assessed using a checklist. The range of possible scores on the lesson plans was 0–50. The overall mean for the lesson plans was 46.73 (SD = 4.86). Results indicate that 103 out of 105 participants scored 70% or more of the possible 50 points on the lesson plan. A large number of participants (87) scored 90–100% of the possible 50 points on their lesson plan. The overall level of performance attained by the participants on the lesson plan is shown in Table 3.

Correlation Analysis

In addition to determining the success of participants in attaining and applying principles of learning and instructional design, a correlation analysis was conducted to examine the relationship among the essentials of learning, competency-based instruction, and lesson plan performance. While all of the correlations were statistically significant at the .01 level, all were of moderate strength (see Table 4).

DISCUSSION

The results of this study indicate that preservice teachers can be successful in acquiring and applying learning and instructional design skills. For acquisition objectives, 95% of all participants acquired the essentials of learning skills and 85% acquired competency-based instruction skills. In addition, almost all of the participants (n = 103) scored 70% or more of the possible 50 points on the lesson plan, with a large number (n = 87) performing at 90% or better.

TABLE 3 ☐ Level of Performance on Lesson Plan

Level of Performance	*Number of Participants*
90–100%	87
80–89%	10
70–79%	6
60–69%	0
0–59%	2

TABLE 4 ☐ Correlations for Essentials of Learning, Competency-based Instruction, and Lesson Planning Performance

Variable	*1*	*2*
1. Essentials of Learning	–	–
2. Competency-based Instruction	.50*	–
3. Lesson Planning Performance	.30**	.45*

*$p < .001$
**$p < .01$.

The large number of partcipants who performed at 70% or better on all three performance measures is not surprising, since the course was designed using a systems approach. In addition, participants were provided with objectives and lesson planning requirements in writing. Under these circumstances, one would not expect scores to be normally distributed.

It is somewhat surprising that 87 out of the 105 participants achieved a 90–100% level of performance on the lesson plan, while far fewer achieved this level of performance on the essentials of learning test (n = 33) and the CBI tests (n = 18). If performance on both tests had been prerequisite to performance on the lesson plan, scores on these measures would have correlated more strongly with one another. However, the relationship between test scores and lesson planning performance was only moderate. Participants may have scored better on the lesson plan than on the tests because they were allowed to use any resource while working on this plan (other than a human consultant), but were required to complete the tests without the use of resources. Another possible reason is that the lesson planning checklist may have allowed for a certain degree of subjectivity in assigning points, while the tests were scored using

entirely objective criteria. The nature of the checklist might also explain why the relationship between lesson plan performance and CBI scores was stronger than the relationship between lesson plan performance and essentials of learning scores. Of the possible total of 50 points on the lesson plan, approximately 70% was related to CBI skills and 30% to the essentials of learning.

The results of this study should be encouraging to instructional technologists concerned with improving education through teacher training. While experienced teachers use systematic models only informally, they report that systematic planning models are useful for student teachers or inexperienced teachers (Neale et al., 1983). Overall, most of the preservice teachers in the current study were highly successful in acquiring and applying learning and instructional design skills, regardless of their area of teaching specialization. This suggests that teachers with different subject matter and grade level concentrations can learn and apply instructional design models. Further research is required to determine if and how preservice teachers who are trained to use systematic planning models will implement these models in their classrooms. □

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