the model and the present use of an E-paced presentation instead of self-pacing, which was used in previous tests of the model.

The assumption that OC places more emphasis upon the response actually made on an error trial than does SC feedback is still tenable and receives some support in the interpretation of certain results. The superior performance (Fig. 1) of OC-SC in both paradigms suggests that OC primed the use of the elimination strategy, which could also be used with SC on the second list, whereas in Group SC-OC, the SC feedback first did not involve the acquisition of any strategy that was equally compatible with OC on the second list, as would be expected if the same processes were involved equally in both cases. This is also true when SC-OC is compared with OC-OC or when OC-SC is compared with SC-SC. Since different processes seem to have been involved, and since the transfer effects are in the expected direction, it is proposed that error elimination is one process that is likely to differ, but two alternatives will be noted.

Buchwald's (1969) distinction between the S's memory for the specific response as opposed to his memory for the outcome of that response to the stimulus does not seem to provide as good an explanation of the transfer effects. That is, SC might make the S less likely to forget either of these events, relative to OC, since he sees each on every trial. While this readily accounts for the more rapid acquisition of the first list with SC, it seems to imply that the first-list associations would also be stronger and thus interfere more during second-list learning, which was not the case. Although this distinction may be involved with other variants in designating outcomes, it does not seem predictive here.

Likewise, it is known (Bjork, 1970) that Ss can benefit from instructions to forget specific items. While the link may not be immediately clear and the procedures do differ substantially, elimination may be useful during acquisition, but the S might then instruct himself to forget later. This being the case, there should be little difference between SC and OC, which was clearly not so.

Neither instructions to forget nor the distinction between memory for the response and outcome seem to provide as adequate an explanation for the feedback effects in transfer as does elimination. Other mechanisms may also be involved differentially in the two feedback conditions, e.g., anxiety (Bower, 1962), but, on the basis of the present data, elimination seems the preferred explanation of transfer differences as a function of feedback method, and elimination of errors seems implicated as a mechanism in A-Br transfer, varying as a function of feedback procedure and possibly other secondary variables.

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The probability of probability concept transfer*

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An attempt was made to demonstrate positive transfer of probability concepts from tasks in a mathematics classroom setting to similar tasks presented outside of the mathematics classroom. The results indicated that learning occurred as a result of classroom instruction. However, there was no evidence of transfer of the probability concepts.

Justification for instruction in a curriculum is commonly made on the grounds that there is positive transfer from the instruction to a variety of tasks not included in the instruction. In spite of this claim, the question of whether positive transfer can be demonstrated in various curriculum areas remains largely unexplored.

The purpose of this study is to demonstrate the positive transfer, if any, obtained through instruction in

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Table 1
Mean Number of Correct Answers in Learning and Transfer

	Concept Test	Transfer Test	
		Pretest	Posttest
Experimental	6.72	7.27	7.97
Control	4.88	6.94	7.26

the concepts of one curriculum subject to tasks highly similar to those included in the curriculum's formal content. The transfer tasks are concerned with the same concepts as appear in the instruction. The subject chosen was probability, partly because transfer of its concepts has never been demonstrated on an elementary school level, but also because of the obvious range of potential applicability of the S's concepts.

The paradigm chosen for transfer (e.g., Underwood, 1966) consists of the comparison of an experimental condition in which the S has received instruction, with a noninstructed control condition on the same transfer task. If performance is superior in the experimental condition, then, assuming adequate control, this superiority defines positive transfer.

MATERIALS

The instructional materials consisted of the activity-oriented probability textbooks written and published by the School Mathematics Study Group for the intermediate grades (School Mathematics Study Group, 1965). Each teacher was supplied with an accompanying teacher's manual consisting of background information, activity suggestions, and instructional procedures. In addition to the texts, activity-oriented materials were made available in the form of dice and spinners.

TESTS

A probability concept test and a probability transfer test were developed by the writers with the assistance of the University of Delaware Mathematics Education staff. The concept test consisted of 15 multiple-choice items specifically designed to test the concepts contained in the instructional unit, using only applications of media employed in the unit (e.g., coin flipping, spinners, and dice). The test-retest reliability was 0.82, using a sample of 21 sixth-grade students.

The transfer test consisted of 22 multiple-choice items designed to test the same concepts as the concept test. The transfer test differed from the concept test in two substantive ways, both of which involved adding possible interfering descriptions of circumstances considered to be familiar to sixth-grade students (e.g., bubblegum machines, rope skipping, and bike riding situations). In the first, some items applied the use of objects such as dice, cards, and spinners, which were also used in some of the concept test tasks, but a circumstance independent of the solution of the problem was introduced. These circumstances were considered to be of the same nature a sixth grader might encounter outside of the classroom (e.g., flipping a coin with his older and more "knowledgeable" brother). In the second, some items called for the use of situations involving objects familiar to sixth-grade students but not employed in the instructional materials or concept test items. In other words, where an item on the concept test might involve the tossing of a coin, a similar item on the transfer test might use a bubblegum machine to present a situation testing the same concept. The test-retest reliability of the transfer test was 0.75, using a sample of 56 sixth-grade students.

PROCEDURE

The Ss were 336 sixth-grade students taught by eight teachers from four Delaware shcool districts. The schools selected were considered to be rather diverse in socioeconomic constituency. Each teacher had two heterogeneously grouped sixth-grade mathematics classes as part of his regular teaching assignment. One class from each teacher's assignment was chosen randomly for the experimental condition; the other was chosen for the control.

The transfer test was administered to both experimental and control classes as a preinstructional measure of equivalence 3 or 4 days before instruction began. To minimize subject sensitization the tests were administered in a classroom other than mathematics by administrators unfamiliar to the Ss. No mention was made of probability. To minimize teacher sensitization, no teacher involved in the experiment saw either test prior to or during instruction. The teachers were given no instructions other than those supplied by the teachers' manual to the probability unit.

The experimental classes were then taught the 3-week probability unit; the control classes continued with their regular mathematics curriculum. Immediately following the instructional period the concept test was administered to both experimental and control classes by the regular mathematics teachers. Three or 4 days later, the transfer test was readministered in the same classroom in which the preinstruction test had been given by a different administrator.

RESULTS

Learning

The mean number of responses on the concept test as well as the pre- and postinstruction administration of the transfer test are presented in Table 1. A 2 (experimental-control conditions) by 8 (teachers) analysis of variance was computed to determine if learning had occurred. The difference between the experimental and control conditions on the concept test, favoring the experimental condition, was significant, $F(1,320) = 66.54$, $p < .01$. This difference, while quite small, suggests that instruction resulted in some acquisition of the probability concepts.

Transfer

To measure transfer of this learning, a 2 (pretest-posttest) by 2 (experimental control conditions) by 8 (teachers) analysis of variance test was computed. Postinstruction administration of the transfer test resulted in more correct responses than preinstruction administration for both the experimental and control conditions, $F(1,320) = 12.75$, $p < .01$. The pre- to posttest gain in the experimental condition, however, did not differ significantly, $F(1,320) = 1.75$, $p > .05$, from the gain in the control condition, thus indicating that no transfer occurred.

DISCUSSION

The principal purpose of this study was to determine if instruction in probability concepts under normal classroom conditions and using teacher-determined instructional procedures would result in positive transfer to a test of the concepts presented in situations containing extraneous conditions. It is apparent that transfer was not obtained. It may be that the degree of learning of the concepts was too small to result in transfer, or that functional concept similarity between the instructional setting and the transfer setting was absent. In any event, the results again show the difficulty of finding positive transfer in problem solving (cf. Duncan, 1961). They may also be interpreted to suggest that temperance be employed in positing positive transfer from curriculum-included concepts to tasks not directly taught, and this is perhaps the major contribution of the study.

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