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CHILDREN’S CONDITIONAL REASONING
PART II: TOWARDS A RELIABLE TEST OF CONDITIONAL REASONING ABILITY

1. INTRODUCTION

This is the second in a sequence of three papers describing an investigation of fifth graders' ability to learn to distinguish between valid and fallacious inferences from simple conditional premises.

The first paper presented the experimental materials. The present paper discusses the measuring instrument used to assess the effect of the experimental materials. This paper also focuses on several problems and difficulties encountered in the development of reliable tests in conditional reasoning. A fairly comprehensive search of the relevant literature failed to reveal the consideration of these problems in previous studies of children's conditional reasoning ability.

2. THE MEASURING INSTRUMENT

In order to examine the effect of the teaching-learning process on students' conditional reasoning ability, a 32-item test was developed. The development process was carried out through several field trials, item analysis and revisions.

Each test item starts with two premises; the first premise is a conditional sentence* formulated with a reasonable hypothetical content designed to make sense to fifth graders in the selected population. In each test item the conditional sentence is followed by a second premise which is its antecedent, its consequent, or one of these denied, thus providing four logical forms for the pair of premises. The test consists of four 8-item sets, each set in one of the following four logical forms:

   AA: Affirmation of the Antecedent, (Modus Ponendo Ponens).
   DC: Denial of the Consequent, (Modus Tollendo Tollens).
   AC: Affirming the Consequent.
   DA: Denying the Antecedent.†

* A conditional sentence is one of the form: 'If a, then b'; 'a' is the antecedent and 'b' is the consequent.
† For a review of the logical form see Table 1.
Each of these 8-item subtests consists of four pairs of items. The conditional premise in each pair is stated in one of the following four negation modes:

- **PP**: No negation occurs in either the antecedent or the consequent.
- **PN**: Negation occurs in the consequent only.
- **NP**: Negation occurs in the antecedent only.
- **NN**: Negation occurs in both the antecedent and the consequent.

Items in the various logical forms and negation modes were interspread. Each item called for a choice of one out of three answers. All items were presented in written form, each item on a separate half-size sheet, all assembled to form a puzzle booklet. The investigators administered the test as a group test. (See paragraph no. 7: Administration, below).

### 3. PROBLEMS ENCOUNTERED IN DEVELOPING THE INSTRUMENT

**3.1 Logical form.** Let \(a, b\) denote two declarative English statements. Table 1 gives the four patterns of inferences of conditional logic.

Following the four logical patterns of inference from conditional premises given in Table 1, it is easy to build up four test-items from any given conditional sentence: e.g., the AA example given in Table 1 would become a test item stating:

- If Jane is Jack's sister, then Jane lives in Washington St.
- Jane is Jack's sister.
- Does Jane live in Washington St.?

Clearly the answer is in the affirmative.

The model presented in Table 1 is within the realm of sentential logic. This is a very limited portion of deductive reasoning. There are many examples of intuitively correct deductions that cannot adequately be mirrored by this model. The case most relevant to this study is exemplified by the following:

- If a positive integer has more than two divisors, then it is not a prime number.
- 26 is a positive integer which has more than two divisors.
- Therefore 26 is not a prime number.

Even though the above deduction very closely resembles the AA pattern of inference, in fact it is not a pure application of AA. Observe that the second given sentence is not exactly the antecedent of the given conditional sentence,