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THE UNIVERSITY OF ALBERTA

USE OF A TEST BATTERY FOR PREDICTING COMPETENCY IN CLOTHING CONSTRUCTION

by

© L. SUSAN HORVATH

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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in

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Use of a Test Battery for Predicting Competency in Clothing Construction submitted by L. Susan Horvath in partial fulfilment of the requirements for the degree of Master of Science in Clothing and Textiles.

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Date April 4, 1979

Abstract

Use of a Test Battery for Predicting Competency in Clothing Construction

by

L. Susan Horvath, Master of Science

University of Alberta, 1979

Professor: Dr. Nelma Fetterman

Faculty of Home Economics

Division: Clothing and Textiles

The purpose of this research was to examine a proposed set of criteria to determine whether these criteria can be used to assess an individual's abilities for clothing construction and comprehension of the processes. The proposed set of criteria included previous knowledge of clothing construction, manual dexterity, and mode of perception. By measuring the students' abilities, one has a basis for adjusting learning experiences in a clothing construction course to these abilities.

The sample consisted of 39 females and one male enrolled in Clothing Construction and the Basic Pattern (CL TX 203), at the University of Alberta. Fifteen female students were enrolled in Experimental Techniques in

Clothing Construction (CL TX 307). Three instruments were administered: the 1978 Revised Placement Test; the Purdue Pegboard subtests; and the Embedded Figures Test. For the CL TX 307 group, the grade received in a previous clothing construction course was used.

Research in the areas of clothing construction pretesting, manual dexterity, and field-dependence-independence provided the theoretical framework for this study. Epps (1972) found a written clothing construction pretest to be a valid predictor of success in clothing construction, the final course grade being the measure of success. When multiple regression analyses were performed on the data, the findings indicated that for the CL TX 203 group the mark received on the placement test significantly explained the variation in competency in clothing construction. For the CL TX 307 group the grade received in the prerequisite course, CL TX 203, significantly explained variability in competency in clothing construction.

Tiffin and Asher's (1948) work on manual dexterity provided the basis for this portion of the study. The results indicated that the manual dexterity required for clothing construction must differ from that which is measured by the Purdue Pegboard as the Purdue Pegboard subtests did not significantly explain variability in clothing construction skill as measured by the scores on clothing construction projects.

Work by Witkin et al. (1971), developers of the

Embedded Figures Test, provided the framework for the portion of the study dealing with mode of perception. The results suggested that the ability required to break up the organized field presented in the EFT must differ from the ability needed to understand clothing construction concepts and apply them. As well, the material that is to be learned in the clothing construction courses examined in this study may tend to be presented in an organized form so that structuring is not called for, and differences in the learning of field dependent and field independent students may not be apparent.

The 1978 Revised Placement Test, currently in use at the University of Alberta, was determined to be the most useful measure for predicting competency in clothing construction. The Purdue Pegboard Test and the Embedded Figures Test did not significantly improve the predictive ability of the test battery.

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I. INTRODUCTION

A. Statement of the Problem

One major goal of education is imparting knowledge to students in a manner that is beneficial to each. This is only possible if educators acknowledge the existence of individual differences and plan learning experiences that meet each student's needs (Chadderdon, 1977). Cronbach (1967) notes, regrettably, that "most tactics the school uses are intended to minimize the nuisance of individual differences so that it can go on teaching the same unaltered course" (p.27). Such tactics, obviously, do not benefit each student equally, and tend to disregard the presence of individual differences.

Obvious differences do exist among individuals in their level of accomplishment of a given task. Certainly there are those who excel in specific areas, but in other situations the same persons may find themselves deficient and incapable. What determines how proficient one is at a specific task? Perhaps each task has its set of criteria and if one fufills these adequately one can accomplish the job.

The area of clothing construction is one in which distinct differences in skills can be observed among individuals. Some people are more adept at producing garments of high quality construction, while others have difficulty with this same undertaking.

The intention of the researcher in this study was to examine a proposed set of criteria to determine whether these criteria can be used to predict an individual's abilities for clothing construction and comprehension of the processes. The proposed set of criteria included previous knowledge of clothing construction, manual dexterity, and mode of perception.

B. Justification

The need exists to pretest students' entering abilities so that their learning experiences can be adjusted to these abilities. Using this approach in teaching university level clothing construction courses may enable students to receive greater benefit from the instruction and experience gained in the course. By being aware of the students' entering abilities the instructor should be able to help the students select experiences which provide challenge but are not greatly beyond their level of skill. It is likely that students will experience a sense of accomplishment upon successfully completing a project which they have found challenging but not too difficult. The students may then feel more confident and, thus, develop greater skills and competencies.

Instructors of clothing construction at the university level may find the assessment of students' abilities an asset in planning instruction. Such information may help the instructor in developing modes of instruction for different levels of ability. As well, knowledge of a student's abilities may serve as a guide for the instructor in assessing which students are conscientious about their performance, in contrast to more capable students who are not performing in accordance with their abilities. Segmenting the class into groups, such as those requiring additional assistance and those not as likely to, is another possibility.

This study was exploratory in nature as it examined a proposed set of criteria in terms of usefulness in predicting competency in clothing construction. A placement test currently in use at the University of Alberta was administered to beginning clothing construction students. This test was an indicator of previous knowledge in clothing construction, and scores on the test were used in this study. In addition, the researcher administered the Purdue Pegboard, a measure of manual dexterity, and the Embedded Figures Test, a measure of field-dependence-independence, to examine how much more variability in competency in clothing construction was explained by using the additional instruments. The researcher examined the possibility that the additional instruments provided information concerning abilities the student possessed but are not measured by the placement test. As well, the compilation of a battery of tests, provided that more than one of these suggested criteria proved applicable to clothing construction, was investigated. Such a test battery could then be administered to students initially enrolling in clothing construction courses at the University of Alberta in an effort to evaluate students' abilities, and use the assessment in planning learning experiences appropriate to their abilities.

C. Objectives

The objectives for this study were:

1. To examine the interrelationships of previous knowledge of clothing construction, manual dexterity, and field-dependence-independence with (a) clothing construction skill as measured by score on clothing construction projects, (b) knowledge of clothing construction as measured by score on written assignments and examinations covering course work, and (c) competency in clothing construction as measured by the final grade in the course.
2. To determine if the use of instruments in addition to the placement test contributes significantly to the explanation of variability in level of competency in clothing construction.
3. To investigate the compilation of a battery of tests which would be useful for predicting competency in clothing construction.

Each of these objectives will be examined separate... in relation to two clothing construction courses offered at the University of Alberta, CL TX 203 and CL TX 307.

D. Hypotheses

1. A significant amount of variation in clothing construction skill is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.
2. A significant amount of variation in knowledge of clothing construction is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.
3. A significant amount of variation in final grade in the course is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

E. Operational Definitions

CL TX 203: Clothing Construction and the Basic Pattern. This single-term course involves the application of basic principles in constructing and fitting garments.

CL TX 307: Experimental Technique in Clothing Construction. This single-term course concentrates on analysis and modifications of construction techniques in relation to prescribed standards, and experimentation in handling fabrics which require special techniques. CL TX 203 or advanced placement (based on placement test) is the prerequisite for this course.

Clothing construction skill : The physical and mental activity required for constructing garments as measured by the sc on clothing construction projects.

Knowledge of clothing construction: The mental processes required for the recall and use of factual information pertaining to clothing construction problems as measured by the score on written examinations and assignments.

Competency in clothing construction: This is defined as a three part measure including score on construction projects, score on written assignments and tests covering the course work, and the final grade received for the course. The grading is done by the respective course instructors for CL TX 203 and CL TX 307.

Grade: Mark assigned to students at the University of Alberta for course work. A nine-point grading system is employed. Nine is the highest score possible and one is the lowest.

Field-dependence-independence: Mode of perception as measured by Witkin's Embedded Figures Test.

Manual dexterity: The ability to make skillful, well-controlled arm-hand movements, involving the manipulation of fairly large objects at a rapid rate (Anastasi, 1976, p.445; Fleishman, 1962; Fleishman, 1953), as measured by the Purdue Pegboard subtests.

F. Assumptions

1. The paper-and-pencil placement test is an adequate measure of a student's previous knowledge of clothing construction.
2. Grades are assigned by each instructor in a comparable manner.

Several precautions were taken to ensure that the second assumption could be made. In CL TX 203 the instructors conferred prior to marking the two exams given during the term and the final garment. They also agreed on a system of marking to ensure comparability in the assignment of marks. The final exam was multiple choice so there was no variation in marking. The instructors of CL TX 307 ensured comparability of marking by having the same instructor mark all of the student's work on a given sample or written examination. When grading the final project the instructors consulted each other to ensure comparability in assigning marks.

G. Limitations

This study was limited by the following factors:

1. Sampling was non-random; thus, the findings of this research cannot be generalized beyond this study.
2. The placement test employed was designed for a specific course, limiting the use of the proposed test battery to

the University of Alberta.

3. Three assignments in CL TX 203, comprising 20 percent of the final grade, were not included in the analysis as they could not be categorized as purely written or practical construction assignments.

II. REVIEW OF LITERATURE

The review of relevant literature which follows is presented in three main sections: Educational Pretesting, Manual Dexterity, and Field-Dependence-Independence.

A. Educational Pretesting

The testing of students prior to, or in the early stages of, a course is a common manner in which individual differences are measured (Glaser and Nitko, 1971). Chadderdon (1977) has pointed out that learning difficulties such as an inadequate vocabulary, poor muscle coordination, careless methods of problem solving, and others, can be discovered through the use of appropriate tests. The additional knowledge the teacher gains about the student through pretests can aid in planning a teaching strategy which seems likely to save time and frustration for students and teacher (Chadderdon, 1977). The measures provided by pretests do not necessarily define clearly problem areas, but they make the teacher more aware that certain difficulties exist than would be the case if no pretesting measures were available. Many researchers agree with this concept of pretesting and stress the importance of being able to tailor instruction to meet the needs of the students (Burge, 1974; Caudill, 1968; Fleck, 1974, p. 364; Glaser and Nitko, 1971; Measuring Student Achievement, 1975). Caudill (1968) and Fleck (1974, p. 364) have suggested that the information gained can be used for exploratory, diagnostic, and guidance purposes. Burge (1974) and Goslin (1963, p.47) have added that homogeneous grouping is another possibility.

The individual differences that are measured in the pretest situation include knowledge, prior experience, developed skills, and potential abilities (Singer, 1975, p.291). A skill, which is task-specific, is attained with experience. It usually is considered in relation to a specific sequence of responses on a task or related group of tasks (Fleishman, 1962; Singer, 1975, p.34). Singer (1975, p.33) has added that a skill is a relative quality, not one which can be defined in absolute terms. A person may be deemed highly skilled in comparison with a group of less-experienced persons, but in a group of persons with much more experience his skills may seem inadequate. A skill, therefore, is an indication of what an individual has learned. Because of the specificity of a skill, much pretesting does not actually measure skills, but instead measures potential abilities.

An ability is considered to be more general than a skill, and it is abilities that form the basis of specific skills (Schmidt, 1975, p.120). Gagne and Fleishman (1959, p.100) have emphasized that abilities are measured in terms of human performance, and they are not visible characteristics. When we measure observable human performance we infer the existence of an ability. Several researchers agree that an ability is thought to be inborn, rather general and enduring, and in the adult stable and relatively resistant to change (Fleishman, 1967; Schmidt, 1975, p. 120; Singer, 1975, p.34). Although an ability is a trait which is affected by both heredity and learning (Singer, 1975, p.34), most of the development due to learning occurs during childhood and adolescence (Fleishman, 1967). Because basic abilities are fairly stable in the adult, knowledge of these makes prediction of subsequent performance possible (Fleishman, 1967; Singer, 1975, p.215).

Schwarz (1971) has pointed out that in order to employ efficient pretesting instruments one must determine the attributes and skills the course hopes to develop. There is little to be gained in the use of tests which do not supply information appropriate to the course (Goslin, 1963, p.153). Webster (1969) has emphasized the importance of using a number of devices to gain relevant information, rather than relying on a single instrument. This is due to the fact that the complex structure of human abilities precludes the proper evaluation by a single measure.

In addition, test scores are not usually the sole criterion for classifying and grouping individuals (Goslin, 1963, p.47). Some individual variations are not amenable to present test situations, and knowledge of such must be gained through personal interaction. Thus, test scores function by providing an additional amount of information helpful in making decisions about the student.

Clothing Construction Pretesting

Pretesting students preparing to enter clothing construction courses is practised in many educational settings. Educators recognize that wide variations in background experience and abilities exist among the students (Wright and Henkel, 1951). Such variations seem to be especially significant at the beginning of college level courses (Burge, 1974), suggesting the importance of pretesting at this point. A written pretest in clothing cons ction appears to be the most commonly used type of pretest. The pretest is usually tailor-made to suit the requirements of the construction course the student is entering, and may include questions concerning construction principles, sewing machine operation, and fitting and design principles. The results of such a pretest can aid the instructor in analyzing the potential problem areas in the future course work, as well as identifying the approximate levels of knowledge the students possess (Shaw 1971). This is a benefit if the instructor aims to encourage the less-experienced students and challenge the more-experienced ones (Wright and Henkel, 1951).

A practical skills pretest has also been used for clothing construction courses. Actual clothing construction skill is tested by giving the students practical skills problems which necessitate the construction of samples employing a variety of sewing techniques. Practical skills tests require an excessive amount of time to prepare, administer and score, and as a result other testing methods are often considered in place of the practical test (Henson, 1975). Possible replacements include standardized dexterity tests (Evans, 1947; Henson, 1975; Scholtes, 1948), dexterity questionnaires (Burge, 1974; Scholtes, 1948), experience questionnaires (Burge, 1974; Epps, 1972; Hale, 1963; Rothgarn, 1962; Semeniuk and Galbraith, 1964), and most commonly, paper-and-pencil tests which are less expensive to prepare, and easier to administer and score (Berry, 1963; Caudill, 1968; Collins, 1953; Epps, 1972; Hale, 1963; Hoskins, 1959; Semeniuk and Galbraith, 1964; Walli, 1968).

Several researchers have investigated the use of a paper-and-pencil pretest for clothing construction students. Caudill (1968) administered a written clothing construction pretest to students at Ohio State University. The results showed a positive relationship between past experience and scores on the pretest, suggesting that the pretest measured knowledge gained through experience.

Walli (1968) adapted test items from college pretests to produce a pretest suitable for the high school students she tested. The discrimination power of the test was low, and Walli attributed this partly to the low indices of discrimination exhibited by the true-false questions included in the test. Easy and hasty guessing of correct answers when the student did not know the answer was cited as the cause. A test composed of multiple choice questions may prove to be a better discriminator, as the chance of correct guessing is reduced (Walli, 1968).

Semeniuk and Galbraith (1964) gave a paper-and-pencil pretest to beginning clothing construction students during registration at South Dakota State College. They found the results of the test were valuable for several reasons. The instructor was able to identify the amount of experience and learning in the different areas of clothing construction the students possessed. Thus, it was possible for the instruction to be individualized, and the needs of all students better met. In addition, the students became more aware of gaps in their knowledge of clothing construction and were more receptive to the instructor's presentation of the course material.

Hoskins (1959) administered a basic clothing pretest to students in colleges and universities in New Mexico. It was concluded that the pretest was valid and reliable, and contributed in the diagnosis of individual student's strengths and weaknesses. Hoskins noted that a written test evaluates understanding of the skills and principles involved in clothing construction. However, the study recommended that a practical test be administered as well, permitting the evaluation of the level of the skills the students possess. The combined results of the written and practical pretests could act as a guideline for exempting students from a course, aid in placing transfer students, and assist instructors in planning the course work.

Collins (1953) pretested beginning clothing construction students through the use of an objective, written examination. The suggested uses for a pretest of this nature included grouping of students according to their knowledge of clothing construction, aiding instructors in planning course work which can meet the students' needs, and making students aware of the skills and knowledge they are expected to acquire in the course.

Fothgarn (1962) developed a written pretest and experience questionnaire for students in an introductory clothing construction course at Michigan State University. The pretest was considered useful as it appeared to increase student awareness of new material, and encouraged students to seek more information about clothing construction. The experience questionnaire asked the students' opinions of their clothing construction ability, but this information had relatively little correlation with the final course grade. Rothgarn suggested that perhaps it is difficult for students to assess accurately their capabilities.

Berry (1963) revised a pretest in use at Oklahoma State University and administered it to beginning clothing construction students. Analysis of the pretest indicated the need for further revision, including the addition of more practical type test items to improve the validity. The pretest was designed to be an exemption device, not a predictor of success, but Berry noted that there tended to be a elationship between scores on the pretest and the final ourse grade.

Hale (1963) evaluated the effectiveness of a placement test used for sectioning beginning construction students at Oregon State University. The test battery included an experience questionnaire, a clothing construction pretest, and the Miller Survey of Object Visualization. The final course grade (the measure of effectiveness of placement) was moderately related to the clothing construction pretest. When the Miller test scores were combined with the pretest scores the correlation with the final grade increased. As the experience questionnaire did not make a valuable contribution to the test battery, it was suggested that this instrument be revised.

Epps (1972) developed a written pretest as a predictor of success in a basic clothing construction course at Winthrop College. She found the written pretest to be a valid predictor of success in the course, measuring success by the student's final grade. Epps also used an experience questionnaire and a practical pretest in her battery, but found no significant relationship between these measures and the final course grade.

Henson (1975), on the other hand, found the highest correlation to exist between a practical skills test and course grade. She also noted a significant correlation between an experience index and final grade, and the least correlation between scores on a written pretest and course grade.

The drastic differences in the findings of these latter two studies can be attributed to variations in the testing instruments used. These clothing construction pretests are not standardized instruments, and in both studies were, in fact, being used for the first time. This emphasizes a point made by Goslin (1963):

> A test's predictive value depends on the relationship between the abilities required by the test and the abilities required in the situation in which the performance is to be predicted. (p. 153)

B. Manual Dexterity

Manual dexterity tests have been in use for many years, commonly for the measurement of employees' potential dexterity ability in various industries. Choosing a specific dexterity test depends on several factors such as resembling the job both in content and complexity (Fleishman, 1953; Gagne and Fleishman, 1959, p.254), not requiring a skilled technician for administration and scoring (Kane and Gill, 1972), and realistic costs and time incurred from the use of the test (Kane and Gill, 1972).

The major goal when using such tests is to predict ability of the individual in the performance of a given task, based on the measures derived from the dexterity test (Schmidt, 1975, p.118). The underlying assumption is that the greater the resemblance between the test and the job, the better the test functions as a predictor of success (Fleishman, 1953). Anastasi (1976, p.444) has stated that this is possible if the job and the test require the use of the same muscle groups. Surgent (1947) has stressed that we cannot categorize such aptitudes unambiguously, and must regard specific terms such as finger dexterity as being merely descriptive of what the individual does. As it is often difficult to state clearly the similarities between two tasks, comparing common ability requirements is one method used (Gagne and Fleishman, 195 , p.254). The discrepancies often noted in results of studies using dexterity tests may be partially attributed to this inability to agree explicitly on the specific abilities that are being measured.

Despite this, experiments have shown that measures based on a dexterity test are related to the quality and quantity of work performed by an individual on a variety of jobs which require such dexterity (Tiffin and Asher, 1948). Gagne and Fleishman (1959) noted the following:

> The abilities possessed by different individuals help to predict (a) the rate at which specific skills requiring these abilities are learned and (b) the final level of proficiency which is attained in these skills. (p.221)

In a study by Henson (1975), conducted at the University of Arkansas, a test battery consisting of a written pretest, an experience questionnaire, and a practical skills test, was administered to clothing construction students. The highest correlation was found to exist between scores on the practical skills test and the course grade. This test, however, required three hours to administer, was expensive, and required more time than the other instruments to prepare and grade. Because of these disadvantages, Henson recommended replacing the practical skills test with a standardized dexterity test.

<u>Studies Using Dexterity Tests</u>

Evans, in 1947, did precisely what Henson's (1975) more recent study recommended. Evans replaced the Saddler practical skills test, then in use at Iowa State University, with the O'Connor Dexterity Test. Evans found a sufficiently high correlation to warrant this replacement in the test battery.

Scholtes (1948) continued with research similar to Evans' and attempted to refine further the test battery used at Iowa State University. Scholtes did not find a high correlation between the O'Connor Finger Dexterity Test and final grade, as Evans had. Scholtes also used a Finger Dexterity Questionnaire, assigning numerical values to previous experiences such as playing selected musical instruments, typing, and sewing, and found this measure to correlate more highly with final grade. Like Evans, Scholtes noted that the practical pretest could be eliminated from the battery without serious loss.

Nieman (1961) administered the revised Saddler Paper-and-Pencil Test, the Finger Dexterity Questionnaire developed by Scholtes (1948), and the Miller Survey of Object Visualization to beginning clothing construction students. The criteria chosen as indicators of success in clothing construction included the final course grade and both the instructor's and student's opinions of the best placement for the student. The results indicated that the Saddler and the Miller tests correlated higher with each criterion than did the Finger Dexterity Questionnaire. Nieman did not suggest eliminating the dexterity questionnaire but noted that it could receive a lower weighting than the other tests in the battery.

Burge (1974) developed an Experience Questionnaire which included questions similar to those found in the Finger Dexterity Questionnaire Scholtes (1948) developed. Burge did not find any of the questions pertaining to finger dexterity effective in predicting ability.

A study done in eight garment plants (Inskeep, 1971) tested employees with the O'Connor Finger Dexterity Test, and a custom made "form board" test. Based on the results of previous studies, Inskeep was surprised to find no associations or significant correlations between employee production records and scores on the O'Connor Finger Dexterity Test and the form board test. Inskeep (1971) stressed that, based on such results, "one should not generalize and conclude that psychomotor tests are without predictive value in other environments in the same or related occupations" (p.713). These results simply indicated that these specific tests were not valid predictors in the garment plants where they were used (Inskeep, 1971).

Some researchers prefer to use paper-and-pencil tests as measures of manual dexterity, as opposed to apparatus tests. Reasons for this include the high cost of building and maintaining apparatus tests, and the individual or small group administration that is inevitable (Fleishman, 1953). Hunter (1975), in a study with Air Force personnel, found a large amount of variance in an apparatus test battery that was unrelated to paper-and-pencil measures. This indicates that what the apparatus tests are measuring is unique to them, and is not being measured by the paper-and-pencil tests. Fleishman and Ellison (1962) have examined paper-and-pencil tests which purport to measure motor speed, eye-hand coordination, finger dexterity, and manual dexterity. They found that the first two never appeared as distinct factors, and that, so far, finger dexterity and manual dexterity can only be measured by suitable apparatus tests. For these reasons Fleishman and Ellison (1962) feel that the use of such paper-and-pencil tests should be discouraged.

The Purdue Pegboard

The developers of the Purdue Pegboard stated the following about this apparatus test:

> It provides separate measurements of the right hand, left hand, and both hands together, and measures dexterity for two types of activity: one involving gross movements of hand, fingers, and arms, and the other involving primarily what might be called "tip of the finger" dexterity needed in small assembly work. (Tiffin and Asher, 1948, p.234)

Super and Crites (1962, p.213) noted that the arm-and-hand dexterity measured by the Purdue Pegboard is a finer type than what the Minnesota Rate of Manipulation Test measures, and the finger dexterity measure is arrived at more realistically than in the O'Connor Dexterity Test. Also, non-essential operations seem to be eliminated to a greater extent in the Purdue Pegboard than in other manual dexterity tests (Super and Crites, 1962). Rim (1962) adds that the Assembly portion of the test provides a measure of two-hand coordination.

Studies using the Purdue Pegboard and other apparatus tests have found results which suggest that manual and finger dexterity may be two separate abilities, with finger dexterity involving finer work than manual dexterity (Bourassa and Guion, 1959). Manual dexterity is the ability to make skillful, well-controlled arm-hand movements, and involves the manipulation of fairly large objects at a rapid rate (Anastasi, 1976, p.445; Fleishman, 1962; Fleishman, 1953). Finger dexterity is defined as the ability to make skillful, controlled manipulations of small objects, involving finger movements primarily (Anastasi, 1976, p.445; Fleishman, 1962; Fleishman, 1953). Although these two factors have been separately identified and measured, it should be mentioned that some tasks require both factors (Fleishman, 1953).

Researchers have contributed further information about the Purdue Pegboard through factor analysis of many apparatus tests. In a study by Bourassa and Guion (1959), the manual dexterity factor had significant loadings on the

Purdue Pegboard subtests for Non-preferred Hand and Both Hands. Although the O'Connor Finger Dexterity Test, was included in this analysis it was not one of the tests upon which the identification of the manual dexterity factor was primarily based. Other researchers (Fleishman and Hempel, 1954; Fleishman and Ellison, 1962) found the Purdue Pegboard Assembly test aided in identifying the manual dexterity factor, but not as significantly as the Non-preferred Hand and Both Hands tests did in the study by Bourassa and Guion (1959).

The finger dexterity factor was clearly identified by the Purdue Pegboard in three factor analytic studies. Fleishman (1954) found the following Purdue Pegboard subtests to be the best identifiers of this factor (in decreasing order): Both Hands, Left Hand and Assembly. The O'Connor Finger Dexterity Test came fourth, and close behind this was Purdue Pegboard, Right Hand. Fleishman and Hempel (1954) reported very similar results, with the exception that the Purdue Pegboard, Left Hand subtest, was a slightly better identifier than the Both Hands subtest. Fleishman and Ellison (1962) found Purdue Pegboard, Both Hands, to be the best identifier of finger dexterity, followed by the subtests Right Hand and Assembly, the O'Connor test came fourth again, and Purdue Pegboard ,Left Hand, was fifth. In all cases the Purdue Pegboard subtests appeared as the three best identifiers, suggesting that these are slightly better measures of finger dexterity than the O'Connor Finger

Dexterity Test.

The Purdue Pegboard was chosen as the apparatus test for this study because, in addition to being a significant identifier of both manual and finger dexterity, it is relatively easily administered. The one-trial testing method can be completed in less than five minutes, a skilled technician is not required for the administration of the test, and the scoring is completely objective and can be done at practically no cost (Kane and Gill, 1972).

C. Field-Dependence-Independence

The terms mode of perception and perceptual style are indicative of an approach a person brings to a variety of situations. Field-dependence-independence is the construct which has been applied to such a style (Witkin, Oltman, Raskin and Karp, 1971). Individuals with a field dependent mode of perception find it difficult to overcome the organization of the surrounding field, and the object and field tend to "fuse", making the separation called for by the task difficult (Faterson, 1962; Witkin, Dyk, Faterson, Goodenough and Karp, 1962, p.35; Witkin et al., 1971). This difficulty in separation is due to the fact that the individual passively conforms to the influence of the context in which the item is presented (Goodenough and Karp, 1961; Witkin et al., 1962, p.35). Field dependence is reflected in the ability to overcome embedding contexts by breaking up the organized field, and separating an item from its context (Goodenough and Karp, 1961; Gough and Olton, 1972; Karp, 1963; Witkin et al., 1962, p.49).

Preferred mode of perception appears to be a persistent characteristic of each individual, and people differ markedly in this regard (Witkin, 1950; Witkin, Lewis, Hertzman, Machover, Meissner, and Wapner, 1954, p.514). Individual differences in perceptual style appear early in psychological development and remain stable over a long period of time (Witkin et al., 1954, p.514).

In the general population, scores from any test of field-dependence-independence do not fall into discrete categories, but form a continuum (Witkin et al., 1962, p.2; Witkin, Moore, Goodenough and Cox, 1977a). The labels of field dependent or field independent simply reflect a tendency to one mode of perception or the other, with strength of this tendency in varying degrees (Witkin et al., 1977a). Witkin et al. (1977a) have stressed that there is no implication that two distinct types of human beings exist. Like the designations "tall" and "short", the terms "field dependent" and "field independent" are relative (Witkin et al., 1971). It is not inherently better or worse to show a tendency to one pole or the other. The value of the associated cognitive styles can only be judged by their adaptiveness to specified life circumstances (Witkin and Goodenough, 1977; Witkin, Moore, Oltman, Goodenough, Friedman, Owen and Raskin, 1977b).

Through research a number of relationships between mode of perception and other attributes have been proposed. Individuals tending to perceive in a field independent manner generally score higher on standard intelligence tests than those whose mode of perceiving is field dependent. This does not indicate that field independent individuals are more intelligent, but likely is due to common requirements shared by both measures (Faterson, 1962; Goodenough and Karp, 1961). Faterson (1962) has suggested that this may also be due to a more analytic approach which is associated with field independence. Through factor analysis, tests involving the ability to overcome embeddedness were found to define clearly the factor identified as analytic ability (Karp, 1963). Finally, field independence was found to include attributes such as autonomy, showing intiative, and the ability to think for oneself (Vernon, 1972; Witkin and Goodenough, 1977).

Often in learning situations the material presented lacks clear inherent structure, requiring the learner to provide the organization necessary to aid learning (Witkin et al., 1977a). The field independent person would be better equipped than the field dependent person to provide such structure and would have less difficulty learning the material. However, Witkin et al. (1977a) have noted:

> When the material to be learned is presented in an already organized form, so that structuring is not particularly called for, field-dependent and field-independent people are not likely to differ in their learning. (p.21)

Embedded Figures Test

In brief, Witkin's Embedded Figures Test (EFT) is a paper-and-pencil test which requires the subject to locate a simple "hidden" figure within a larger complex figure. The test is timed, and the greater the speed with which the hidden figure is discovered, the greater the individual's ability to remain uninfluenced by the field in which the item is embedded (Witkin et al., 1954, p.14). Through a job analysis of the series of tasks involved in the EFT, researchers concluded that what this test assesses primarily is the "ability to break-up an organized visual field in order to keep a part of it separate from that field" (Witkin et al., 1971, p.4).

Since the Embedded Figures Test provides a measure of field-dependence-independence, the previously mentioned relationships between perceptual style and other attributes apply. In addition, relationships particular to the EFT have been noted. The EFT has been shown to be more strongly related to measures of intelligence than other tests measuring mode of perception. Elliot (1961) has suggested that this is because the items contained in the EFT and other aptitude tests are very similar, plus both tests are timed. Thus, in the EFT the subject is aroused by these familiar cues and responds with concern over evaluation and achievement motivation (Elliott, 1961).

Witkin et al. (1954, p.477) have pointed out that if an individual has the basic ability to break up the organized field, this will be demonstrated not only in perceptual test situations, but in problem solving situations too. This has obvious implications for clothing construction students, particularly when reading, understanding, and applying material presented in the form of pattern sewing instructions. This involves transferring perceptual information to a similar, but slightly different, construction problem. Witkin et al. (1971) have summarized this concept:

> Persons who have difficulty disembedding simple figures from complex designs in the EFT tend to do less well in solving that class of problems which require isolating an essential element from the context in which it is presented and using it in a different context. (p. 6)

For the purposes of this study, the Embedded Figures Test was judged to be the most appropriate measure of field-dependence-independence. The processes required for disembedding the simple figure from the complex figure appeared similar to the processes necessary in applying the principle presented in sewing instructions to actual clothing construction. Other considerations which were necessary in choosing a test for a battery were present in the EFT. This test did not require expensive apparatus, the twelve-figure form of the test did not require an unrealistic length of time for administering or scoring the test, and scoring was completely objective (Jackson, 1956; Witkin et al., 1971).

D. Summary

The review of literature has suggested that pretesting students is an effective way of gaining information which will enable the teacher to tailor instruction to meet the needs of the students. In many educational institutions clothing construction pretests are used for this purpose. Scores on two additional test measures may also be related to abilities required for clothing construction. Apparatus tests of dexterity are capable of identifying the existence of manual and finger dexterity factors. The measures provided by such tests have shown correlations with success in tasks requiring dexterity. The Embedded Figures Test of field dependence measures the ability for disembedding a simple figure from a complex figure. This mode of perception may be reflected in problem solving situations, such as clothing construction, requiring the same abilities.

III. METHODS AND PROCEDURES

This chapter includes the theoretical framework, selection of the sample, description of the instruments, and analysis of data.

A. Theoretical Framework

The theoretical framework for this study arose out of research in three separate areas, namely clothing construction pretesting, manual dexterity, and field-dependence-independence.

Epps' (1972) work on a clothing construction pretest provided the basis for this segment of the present study. Epps found the written pretest she developed to be a valid predictor of success in clothing construction, the final course grade being the measure of success. A predictive measure such as this would enable the instructor to give additional attention to those students who are more likely to experience difficulty, or group the students according to their previous knowledge.

Tiffin and Asher (1948) found that a relationship exists between measures based on a dexterity test and the quality and quantity of work performed by an individual on tasks which require dexterity. When one considers the arm-hand movements required in handling a garment being constructed, plus the finer movements the fingers perform throughout the process, it is obvious that clothing construction is a task which does involve dexterity. After administering a time-consuming practical skills test in clothing construction, and noting the movements required to perform the test, Henson (1975) suggested replacing the practical skills test with a standardized dexterity test.

Work by Witkin et. al (1971) suggested that individuals who tend to perceive in a field dependent manner, as measured by the EFT, also tend to have difficulty isolating essential information from the context in which it is presented and applying it in a different context. In clothing construction, printed instructions are presented as line drawings, in two-dimensional form, with a text. The individual must be capable of taking this information out of the context in which it is presented and applying it to a three-dimensional situation, namely, the article being constructed. It appears likely that a student whose mode of perception is field independent would understand more readily clothing construction concepts and be better able to apply them, than a student whose mode of perception is field dependent.

Rather than looking at only one of these three measures (namely, previous knowledge of clothing construction, manual dexterity, and field-dependence-independence), it may prove valuable to examine all three in relation to level of competency in clothing construction. Each instrument measures a different ability, providing more comprehensive information about the students' abilities than could be supplied by a single measure. Thus, a combination of these measures may explain a significantly greater amount of the variability in competency in clothing construction than could be explained by any one measure alone.

B. Selection of the Sample

The sample consisted of all the students enrolled in Clothing Construction and the Basic Pattern (CL TX 203), and Experimental Techniques in Clothing Construction (CL TX 307), in the first term of the 1978-1979 academic year, at the University of Alberta.

Procedure

The students were contacted early in the term, and at this time the researcher explained the testing procedure. A timetable was circulated in each class so that each student could select a time for individual testing. The maximum amount of time required for the testing was 50 minutes per student. Reminder slips were given to the students in an effort to have them remember the appointment and be on time. Approximately 50 hours over a period of 8 weeks were required to complete the testing of all the students.

C. Description of the Instruments

Clothing Construction Placement Test

For several years the Clothing and Textiles division at the University of Alberta has administered a clothing construction placement test. Students are given this test prior to registering in CL TX 203. If the student receives a grade higher than a predetermined pass mark, the student has the option of enrolling in CL TX 203 or enrolling in CL TX 307, a more advanced level course.

The placement test used by the division is under frequent revision. Changes in the placement test result from changes in the course content upon which the test is based, refinement of test items based on results of the test being used as a posttest, and changing the amount of time required to complete the test. One revised version was used from 1972 to 1975. This test was revised again in August, 1975, and used from 1975 to 1977. The most recent changes to the test were made in Winter Term of the 1977-78 academic year, and this test was used as the final exam for the CL TX 203 students in April, 1978.

The 1978 Revised Placement Test consisted of 90 items. Sixty-seven questions were multiple choice and 23 were true-and-false. Sixty questions were related to basic clothing construction techniques and principles of construction. The remaining 30 questions covered the fitting of garments and pattern alterations. Estimates of item-total test reliability, carried out by applying Kuder-Richardson

Formula 20 (Gulliksen, 1950, p.224) to he placement test scores of 49 subjects, yielded a coefficient of .88.

For those students enrolling in CL TX 203 in September, 1978, the placement test was administered in September, prior to the commencement of classes. This provided the necessary scores for the variable previous knowledge of clothing construction.

Purdue Pegboard

The Purdue Pegboard Test is a measure of manual and finger dexterity. Five separate scores may be obtained with this test: Right Hand, Left Hand, Both Hands, Total (Right plus Left plus Both Hands), and Assembly.

The Purdue Pegboard is an apparatus test consisting of a pegboard, pins, collars, and washers. The student is seated at a table approximately 30 inches high, with the board placed directly in front, and the cups containing the pins, collars and washers are at the far end of the board.

Brief instructions for the subtests are as follows: (*Purdue Pegboard Examiner Manual*, 1961)

Right Hand: Using the right hand (or the left if it is the preferred hand) the student puts the pins in the holes one at a time. The score is the number of pins placed in 30 seconds.

Left Hand: The instructions are the same as for the Right Hand test but the left hand (non-preferred hand) is used.

Both Hand Simultaneously, the student picks up one pin with the right hand and one with the left, and inserts the pins in two rows of holes. The score is the total number of pairs of pins placed in 30 seconds.

Total: This score is obtained by adding together the three previous subtest scores.

Assembly: This sequence consists of assembling pin, washer, collar, and washer using the right, left, and right and left hands respectively. A complete assembly consists of four parts so the score for this subtest is calculated by multiplying the number of completed assemblies by four, and adding one point for each part properly placed in the final, uncompleted assembly. The time for this subtest is one minute.

Before timing each subtest the student was allowed to practice placing a few pins or assemblies to ensure complete understanding of what was required.

The reliability coefficients for the Purdue Pegboard subtests are presented in Table 1 (Tiffin and Asher, 1948, p.244). The reliabilities for the one-trial and three-trial methods are presented for comparative purposes. The validity of dexterity tests is situation-specific, requiring a study of the validity of the Purdue Pegboard for specific tasks

The three-trial method of administration was used in this study. This involved repeating each of the subtests three times and adding the scores, as opposed to recording the score for one trial only. The three-trial method, although more time consuming, is more reliable than the

Table 1: Reliability Coefficients of the Purdue Pegboard Subtests

Test	Group	N	One Trial*	Three Trials**
Right Hand	College students (men and women)	434	.63	.84
Left Hand	College students (men and women)	434	.60	.82
Both Hands	College students (men and women)	434	.68	.86
Total	College students (men)	175	.71	.88
Assembly	College students (men and women)	434	.68	.86

*Test-retest reliabilities of college students at Purdue University.
**Three-trial reliabilities obtained in each case by "stepping up" one-trial reliability by means of the Spearman-Brown prophecy formula.

one-trial method. It has been recommended that if precise individual measurement is desired, as in vocational guidance, the three-trial method should be used (Tiffin and Asher, 1948; Purdue Pegboard Examiner Manual, 1961). The three-trial administration required a maximum time of 15 minutes, including the time spent explaining the testing procedure.

All five subtests could not be used as extreme collinearity (intercorrelation in the .8 to 1.0 range) existed between several pairs of these variables. When extreme collinearity exists between independent variables regression analysis will not yield acceptable results (Nie, Hull, Jenkins, Steinbrenner and Bent, 1975, p.340). To overcome this problem, scores from only two subtests were used. The Total subtest was chosen as this allowed all of the subtest results to be included in the analysis, and the Total subtest correlated more highly with the dependent variables than the Right, Left and Both Hands subtests. The scores used in the study were Total (which is the sum of the Right, Left and Both Hands subtests) and Assembly.

Witkin's Embedded Figures Test

The object of the Embedded Figures Test is the locating of a simple figure, which has previously been seen, within a larger complex figure. The score is the speed in seconds with which the student is able to find the hidden figure. There is a three minute time limit for locating each figure. The greater the time required by the student, the more his mode of perceiving tends to be field dependent (Witkin et al., 1954, p.14).

Witkin et al. (1971) report reliabilities for the 12-figure, 3-minute format of .82 for 51 male college students, and .79 for 51 females. These reliabilities were obtained by recomputing scores for tests given in the original 24-figure, 5-minute format (Witkin, et al., 1954, p.124).

Several studies have validated the concept that the EFT is a test of the ability to overcome an embedding context. Witkin et al. (1962) have noted that intercorrelations exist among the perceptual test scores on the EFT, Body-Adjustment Test (BAT) and Room-Adjustment Test (RAT), demonstrating substantial consistency in the functioning required in these situations. The conclusion of this correlational study was that central to the field dependence dimension is the ability to overcome an embedding context. Goodenough and Karp (1961) performed a factor analysis to identify a factor "variously labelled as 'Closure','Performance','Spatial-perceptual', 'Non-verbal Organization','Visualization', and 'Perceptual Speed'" (p. 241). They found the three tests of perceptual field dependence, Rod-and-Frame Test (RFT), EFT, and BAT, and the Children's EFT and Hidden Pictures (which are similar to the EFT) to have their highest loadings on this factor. Goodenough and Karp (1961) have suggested that all of these tests may involve overcoming an embedding context. Karp (1963), based on the results of a factor analytic study, has concluded that the ability to overcome the effects of embedding contexts is involved in measures of field dependence.

The testing began by showing the student the Complex Figure for 15 seconds, and asking the student to describe it. The Complex Figure was then covered, and the Simple Form was shown to the student for 10 seconds. The Simple Form was then removed, the Complex Figure was revealed, and the student was instructed to find the Simple Form in the Complex Figure. When the Simple Form had been found the student traced it with a stylus. This procedure was repeated with each of the 12 Complex Figures in the test, plus a Practice Complex Figure which was administered initially to increase understanding of the procedure (Witkin et al., 1971). Form A of the test was used, and the figures were presented in the suggested order.

Background Information

The age and sex of the participants were recorded on the data sheet for the Embedded Figures Test. This information was used only in describing the sample.

Presentation of the Instruments

The Placement Test was the first of the tests completed by the students as it was administered during registration, prior to the commencement of classes. Individually, the researcher administered to the students the Purdue Pegboard subtests, followed by the Embedded Figures Test. Allowing for an approximate maximum time of 15 minutes for the Purdue Pegboard, and 35 minutes for the Embedded Figures Test, the administration time was approximately 50 minutes.

D. Analysis of Data

Multiple regression analysis was used to determine which variables maximize explained variance in competency in CL TX 203 and CL TX 307. This analysis determined what proportion of the variability can be explained by each of the independent variables. The variables were ordered from greatest to least, in terms of the amount of variability they explained. The first variable listed explained singly the greatest amount of variance, and the results also showed how much more of the variability was explained with the addition of each independent variable. A separate analysis was done for each course. Competency in clothing construction was a three part measure consisting of score on actual construction projects, score on written examinations covering course work, and the final grade received for the course. The independent variables were (1) for the CL TX 203 students, the score on the 1978 Revised Placement Test; for the CL TX 307 students, the grade received for CL TX 203, (2) scores on two Purdue Pegboard subtests, Total and Assembly, and (3) score on the Embedded Figures Test.

IV. FINDINGS

Descriptive and statistical analyses of the data collected through the administration of the 1978 Revised Placement Test, the Purdue Pegboard, and the Embedded Figures Test will be presented in this chapter.

A. Description of the Sample

The sample for the study consisted of 40 students enrolled in CL TX 203, Clothing Construction and the Basic Pattern, and 19 students enrolled in CL TX 307, Experimental Techniques in Clothing Construction. Four students enrolled in CL TX 307 had been granted advance placement (based on the placement test) so had not taken CL TX 203. Since the grade received for CL TX 203 was one of the independent variables used in the analysis of the CL TX 307 students' results, these four students were omitted from the study.

The mean age of the students in CL TX 203 was 21 years, the range was 17-46 years, and this group comprised 39 females and 1 male. The 15 female students enrolled in CL TX 307 were between the ages of 17 and 38 with a mean age of 22.5 years.

B. Descriptive Analysis of the Variables

Tables 2 and 3 present the ranges, means, and standard deviations for the independent variables. Table 2 is based on the scores for the CL TX 203 students, and Table 3 is based on the scores for the CL TX 307 students.

Table 2: Ranges, Means and Standard Deviations for the Independent Variables for CL TX 203 Students (N=40)

Independent Variable	Range	Mean	S.D.
1978 Revised Placement Test (possible range 0-90)	29-59	44.85	7.68
Purdue Pegboard Total	87-152	135.40	11.57
Purdue Pegboard Assembly	61-162	132.55	19.02
EFT	83-777	404.28	162.24

Table 3: Ranges, Means and Standard Deviations for the Independent Variables for CL TX 307 Students (N=15)

Independent Variable	Range	Mean	S.D.
Grade for CL TX 203 (possible range 1-9)	5-8	6.33	0.98
Purdue Pegboard Total	115-157	140.47	12.93
Purdue Pegboard Assembly	109-161	134.73	12.76
EFT	250-1072	538.00	246.80

Table 4 reports comparisons of the range, mean and standard deviation for scores on the EFT with norms for female subjects from studies by Kernaleguen (1968) and Baer (1970). The score on the EFT for the single male in the sample in the present study was not included in the calculation of the mean and standard deviation for comparison with the norms from other studies which used female subjects only. The mean, range and standard deviation for the EFT scores of the total sample are in very close agreement with the findings of Kernaleguen (1968), and in relatively close agreement with Baer's (1970) findings. The sample in the present study, and in the two studies used for comparison, consisted of female college students enrolled in Home Economics courses. This may be a factor contributing to the close agreement in results among the three studies.

Table 4: Comparison of the Range, Mean and Standard Deviation for Scores Obtained on the Embedded Figures Test

Sample	N	Sex	Range	Mean	S.D.
Kernaleguen (1968)	68	F	70-977	438	203
Baer (1970)	102	F	74-1297	477.18	251.25
Horvath (1979)	54	F	83-1072	440.57	197.83

Comparison of the means for scores on two Purdue Pegboard subtests, Total and Assembly, are presented in Table 5.

Table 5: Comparison of the Means for Scores on Purdue Pegboard Subtests Total and Assembly

Sample	N	Total Subtest	Assembly Subtest
Alderman (1949) (male veterans)	150	135.90	120.40
Tiffin and Asher (1948) (college)	434	147.42	126.84
Horvath (1979) (college)	55	136.78	133.15

Alderman (1949) and Tiffin and Asher (1948) report results for the three-trial method of administration of the Purdue Pegboard subtests. Few studies report results for the three-trial administration, limiting the studies available for comparison with the present study. The mean for the Total subtest in this study compares favourably with the results in the Alderman (1949) study, but is lower than that for the Tiffin and Asher (1948) study. The large difference in the sample size of this study and that of Tiffin and Asher (1948) may be contributing to the difference noted in the means. For the Assembly subtest the mean for this study is higher than in the Alderman (1949) and Tiffin and Asher

(1948) studies. The Alderman (1949) sample consisted of males, the Tiffin and Asher (1948) sample was males and females, and the sample in the present study was primarily female (54 females, 1 male). Since females tend to score higher on the Assembly subtest than males (Tiffin and Asher, 1948) this explains the higher mean scores for the Assembly subtest in the present study.

C. Multiple Regression Analysis

Multiple regression analyses were performed to examine the relationships between each dependent variable and a set of independent variables. This analysis determined the proportion of the variability in competency in clothing construction that was explained by each of the independent variables. The variable which explained singly the greatest amount of the variability was listed first, and the remaining variables were listed in order of their relative contribution to the amount of explained variance. The three dependent variables used to define competency in clothing construction included the score on practical construction projects, the score on written portion of course work, and the final grade received for the course. The independent variables were: (1) for CL TX 203, score on the 1978 Revised Placement Test; for CL TX 307, grade received for CL TX 203, (2) scores on two Purdue Pegboard subtests, Total and Assembly, and (3) score on the Embedded Figures Test. A separate analysis was done for each clothing construction course, CL TX 203 and CL TX 307.

Analysis of CL TX 203: Clothing Construction and the Basic Pattern

Hypothesis 1a: A significant amount of variation in clothing construction skill is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

Previous knowledge of clothing construction as measured by the placement test explained 21.5 percent of the variability in clothing construction skill as indicated by the score on a practical construction project in CL TX 203 (p=0.01). The other variables, manual dexterity and field-dependence-independence, did not contribute significantly to the explanation of the variability in scores on the practical construction project (see Table 6).

Hypothesis 2a: A significant amount of variation in knowledge of clothing construction is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

The score on the placement test explained 38.6 percent of the variability in knowledge of clothing construction as indicated by scores on written course work in CL TX 203 (p=0.01). The addition of a second independent variable, score on Purdue Pegboard Assembly Test (a measu of manual dexterity), significantly increased the amou of explained

Table 6: Multiple Regression Analysis for CL TX 203 Scores on Practical Course Work, Written Course Work, and Final Course Grade (Dependent Variables) and Placement Test Score, Purdue Pegboard Total and Assembly, and EFT (Independent Variables) N=40

Dependent Variable	Independent Variable	R-SQ	df	F*	P
Score on Practical Course Work	Placement Test	.215	1,38	10.39	.01
	Purdue Pegboard Total	.237	1,37	1.10	n.s.
	EFT	.255	1,36	0.86	n.s.
	Purdue Pegboard Assembly	.262	1,35	0.33	n.s.
Score on Written Course Work	Placement Test	.386	1,38	23.87	.01
	Purdue Pegboard Assembly	.555	1,37	14.10	.01
	EFT	.586	1,36	2.68	n.s.
	Purdue Pegboard Total	.598	1,35	1.01	n.s.
Final Course Grade	Placement Test	.347	1,38	20.20	.01
	Purdue Pegboard Assembly	.417	1,37	4.42	.05
	Purdue Pegboard Total	.426	1,36	0.55	n.s.
	EFT	.430	1,35	0.29	n.s.

Note. n.s.= not significant
*The F value reported is the F value for the variable when it was initially entered into the regression equation.

variability to 55.5 percent (p=0.01). The remaining independent variables, Purdue Pegboard Total (the second measure of manual dexterity) and field-dependence-independence, did not contribute significantly to the amount of explained variability (see Table 6).

Hypothesis 3a: A significant amount of variation in final grade in the course is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

The score on the placement test explained 34.7 percent of the variability in the final grade (p=0.01). The addition of the Purdue Pegboard Assembly Test scores increased the amount of variability explained to 41.7 percent (p=0.05). The remaining variables, Purdue Pegboard Total (the second measure of manual dexterity), and field-dependence-independence, did not contribute significantly to the amount of explained variability in the final course grade (see Table 6).

Analysis of CL TX 307: Experimental Techniques in Clothing Construction

Hypothesis 1b: A significant amount of variation in clothing construction skill is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

Previous knowledge of clothing construction as indicated by the grade received for CL TX 203, explained

60.8 percent of the variability in scores on practical construction projects (p=0.01). The variables manual dexterity and field-dependence-independence did not contribute significantly to the explanation of the variability in scores on the practical construction projects (see Table 7)

Hypothesis 2 significant amount of variation in knowledge of clothing construction is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

The grade received for CL TX 203 explained 72.2 percent of the variability in scores on written course work (p=0.01). The remaining independent variables, manual dexterity and field-dependence-independence, did not contribute significantly to the explained variability in scores on written course work (see Table 7).

Hypothesis 3b: A significant amount of variation in final grade in the course is explained by previous knowledge of clothing construction, manual dexterity, and field-dependence-independence.

The grade received in CL TX 203 explained 60.5 percent of the variability in the final course grade (p=0.01). The remaining independent variables, manual dexterity and field-dependence-independence, did not contribute significantly to the amount of explained variability in final course grade (see Table 7).

Table 7: Multiple Regression Analysis for CL TX 307 Scores on Practical Course Work, Written Course Work, and Final Course Grade (Dependent Variables) and Grade for CL TX 203, Purdue Pegboard Total and Assembly, and EFT (Independent Variables) N=15

Dependent Variable	Independent Variable	R-SQ	df	F*	P
Score on Practical Course Work	Grade for CL TX 203	.608	1,13	20.14	.01
	EFT	.640	1,12	1.07	n.s.
	Purdue Pegboard Assembly	.691	1,11	1.81	n.s.
	Purdue Pegboard Total	.765	1,10	3.18	n.s.
Score on Written Course Work	Grade for CL TX 203	.722	1,13	33.77	.01
	Purdue Pegboard Total	.736	1,12	0.65	n.s.
	Purdue Pegboard Assembly	.757	1,11	0.94	n.s.
	EFT	.762	1,10	0.21	n.s.
Final Course Grade	Grade for CL TX 203	.605	1,13	19.90	.01
	Purdue Pegboard Assembly	.653	1,12	1.67	n.s.
	Purdue Pegboard Total	.690	1,11	1.32	n.s.

Note. n.s.=not significant
*The F value reported is the F value for the variable when it was initially entered into the regression equation.

V. INTERPRETATION

The first objective was to examine the interrelationships of previous knowledge of clothing construction, manual dexterity, and field-dependence-independence with (a) clothing construction skill as measured by the score on clothing construction projects, (b) knowledge of clothing construction as measured by the scores on written assignments and examinations covering course work, and (c) competency in clothing construction as measured by the final grade in the course.

A. Previous Knowledge of Clothing Construction

In CL TX 203 and CL TX 307, previous knowledge of clothing construction was the variable which explained the largest amount of the variability for all three dependent variables, clothing construction skill, knowledge of clothing construction, and competency in clothing construction.

Caudill (1968) noted that a positive relationship existed between past experience in clothing construction and scores on a clothing construction pretest, suggesting that the pretest measured knowledge gained through experience. Similarly, the administration of the 1978 Revised Placement Test to the CLTX 203 students provided a measure of knowledge gained through experience. For the CL TX 307 course there was no placement test, so the grade received in the prerequisite course, CL TX 203, was used as a measure of knowledge gained through experience. Hence, the placement test and the grade received in a previous clothing construction course can be considered measures of the same variable, namely, previous knowledge of clothing construction.

The score students received on the measure of previous knowledge of clothing construction was a meaningful predictor of the score they received on actual construction projects, written assignments and examinations covering the course work, and the final course grade. This result was anticipated because students with more experience and previous knowledge of clothing construction tend to perform better in a clothing construction class than students with little or no background experience. This result supported evidence from other studies (Berry, 1963; Epps, 1972; Hale, 1963; Nieman, 1961).

In CL TX 203, previous knowledge of clothing construction explained a relatively lower percentage of the variation in the dependent variables, than in CL TX 307 (see Table 8). This may be due to several factors. The administration of a placement test prior to enrolling in a clothing construction course has the effect of making students more aware of gaps in their knowledge of clothing construction (Semeniuk and Galbraith, 1964), indicating to students the level of achievement that will be expected (Collins, 1953), and promoting a desire to gain more

Table 8: Percentage of the Variation in the Dependent Variables Explained by Previous Knowledge of Clothing Construction

Dependent Variable	CL TX 203 (Placement Test Score)	CL TX 307 (Grade in CL TX 203)
Score on Practical Course Work	21.5%	60.8%
Score on Written Course Work	38.6%	72.2%
Final Course Grade	34.7%	60.5%

knowledge about clothing construction (Rothgarn, [illegible]2). Due to these effects of the placement test administration one would expect, as noted by Semeniuk and Galbraith (1964), that the students who had written the placement test would be more receptive to the instruction provided in the course than students who had not written a placement test. Thus, the presentation of course material and the assistance provided by the instructor may be the factors that explained a large portion of the unexplained variation in clothing construction ability.

The measure of previous knowledge of clothing construction for the CL TX 203 group was based solely on the score received on a written placement test. In CL TX 307, on the other hand, the measure of previous knowledge of clothing construction was the grade received in CL TX 203 which was a composite of scores on written exams and practical construction projects. The more comprehensive measure of previous knowledge of clothing construction used for the CL TX 307 group may be another factor contributing to the larger percentage of variation in the dependent variables explained by previous knowledge of clothing construction in CL TX 307 than in CL TX 203.

Another factor that should be considered is that the scores for the practical course work and the written course work for CL TX 203 did not encompass 100 percent of the final grade. Three assignments in CL TX 203, comprising 20 percent of the final grade, were not included in the analysis as they could not be categorized as purely written or practical assignments.

There are other considerations that must be made when examining the differences in the amount of explained variability in the dependent variable between CL TX 203 and CL TX 307. In CL TX 203 the score for the practical course work was based on a single construction project, whereas in CL TX 307 the score was based on several samples and a final garment. As well, the students who received the highest score on the placement test by-passed CL TX 203 and, thus, were not included in the sample.

B. Manual Dexterity

The variable manual dexterity was not significant in explaining variation in clothing construction skill. Fleishman (1953) noted that the underlying assumption when administering a dexterity test is that the greater the resemblance between the test and the job, the better the test functions as a predictor of success. Tiffin and Asher (1948) stated that a given dexterity test may be a satisfactory measure for certain manual tasks, yet unsuitable for other tasks which seem to be similar. Thus, the manual dexterity required for clothing construction must differ from that which is measured by the Purdue Pegboard.

Evans (1947) found a high correlation between the O'Connor Dexterity Test and practical clothing construction skills. Scholtes (1948), in a study similar to one by Evans (1947), did not find a high correlation between the O'Connor Dexterity Test and construction skills.

Inskeep (1971) administered the O'Connor Finger Dexterity Test to employees in eight garment plants. The study found no associations with chi-square testing, and no significant correlations using regression analysis, between employee production records and scores on the O'Connor Finger Dexterity Test.

The results of the present study, therefore, supported evidence from other studies. Although there are studies with conflicting results (Evans, 1947), Gagne and Fleishman (1959) cautioned that the discrepancies often noted in the results of studies using dexterity tests may be attributed, in part, to the inability to agree explicitly on the specific abilities being measured.

The score received on the Purdue Pegboard Assembly subtest significantly increased the amount of explained variability in written course work for the CL TX 203 students only. This was a rather perplexing result as there does not seem to be a logical and explainable relationship between manual dexterity and scores on written examinations.

In the CL TX 203 group the Purd e Pegboard Assembly subtest score increased the amount of explained variation in the final course grade. The final course grade is a composite score which includes the first two dependent variables (a) score on practical construction projects and (b) score on written course work. Since the Purdue Pegboard Assembly subtest increased the amount of explained variability in the score on written course work, it was not ing that it was also entered as a significant variable n explaining variability in final course grade.

C. Field-De enuence-Independence

T sco on the Embedded Figures Test did not significar contribute to the explained variation in scor s or ractical construction projects, written ass nts and examinations, and the final course grade. work by Witkin, et al. (1971) suggested that individuals whose mode of perception tends to be field dependent, as measured by the EFT, tend to have difficulty isolating specific information from the context in which it is presented and applying it in a different context. The results of this study suggested that the ability required to break he organized field presented in the EFT must diffe m the ability needed to understand readily clothing concepts and to apply them satisfactorily. As well, the material that is to be learned in the clothing construction courses examined in this study may tend to be presented in an already organized form. Witkin et al. (1977a) noted that, when the material presented is organized, structuring is not called for necessarily, and differences in the learning of field dependent and field independent students may not be apparent.

The second objective set for this research was to determine if the use of instruments in addition to the placement test contributed significantly to the explanation of variability in competency in clothing construction. The variables examined in addition to the placement test included manual dexterity and field-dependence-independence. The findings of this research suggested that the additional variables did not significantly improve the explanation of variability in competency in clothing construction.

The final objective of the study was to investigate the compilation of a battery of tests which would be useful for predicting competency in clothing construction. The time and manpower required for the administration of a battery of tests were prime considerations. As such, the results of the study indicated that the single variable, previous knowledge of clothing construction, could be determined by administering the 1978 Revised Placement Test as the sole instrument in the test battery. This independent variable explained the largest amount of the variability for all three dependent variables, clothing construction ability, knowledge of clothing construction, and competency in clothing construction. Only in the case of knowledge of clothing construction, as measured by the scores on written course work for the CL TX students, was the amount of explained variability significantly increased when the Purdue Pegboard Assembly subtest was added. At no time was the amount of explained variability significantly increased when the Purdue Pegboard Total subtest or the Embedded Figures Test was used. Therefore, of the three measures used in this study, the 1978 Revised Placement Test, two Purdue Pegboard subtests (Total and Assembly), and the Embedded Figures Test, the 1978 Revised Placement Test was the most useful.

VI. SUMMARY AND RECOMMENDATIONS

The purpose of this research was to examine a proposed set of criteria to determine whether these criteria can be used to assess an individual's abilities for clothing construction and comprehension of the process. The proposed set of criteria included previous knowledge of clothing construction, manual dexterity, and mode of perception. By measuring the students' abilities, one has a basis for adjusting learning experiences in a clothing construction coursé to these abilities.

The sample consisted of 54 females and one male. Thirty-nine females and one male were students enrolled in Clothing Construction and the Basic Pattern (CL TX 203), at the University of Alberta. The remaining 15 female students were enrolled in Experimental Techniques in Clothing Construction (CL TX 307). Three instruments were administered: the 1978 Revised Placement Test; the Purdue Pegboard subtests; and the Embedded Figures Test. For the CL TX 307 group, the grade received in a previous clothing construction course was gleaned from student records.

Research in the areas of clothing construction pretesting, manual dexterity, and field-dependence-independence provided the theoretical framework for this study. Epps (1972) found a written clothing construction pretest to be a valid predictor of success in clothing construction, the final course grade being the measure of success. When multiple regression analyses were performed on the data, the findings indicated that for the CL TX 203 group the mark received on the placement test significantly explained the variation in competency in clothing construction. For the CL TX 307 group an appropriate placement test was not available. In its place the grade received in the prerequisite course, CL TX 203, was used, and significantly explained the variability in competency in clothing construction.

Tiffin and Asher's (1948) work on manual dexterity provided the basis for this portion of the study. The results indicated that the manual dexterity required for clothing construction must differ from that which is measured by the Purdue Pegboard as the Purdue Pegboard subtests did not significantly explain variability in clothing construction skill as measured by the scores on clothing construction projects.

Work by Witkin et al. (1971), developers of the Embedded Figures Test, provided the framework for the portion of the study dealing with mode of perception. The results suggested that the ability required to break up the organized field presented in the EFT must differ from the ability needed to understand clothing construction concepts and apply them. As well, the material that is to be learned in the clothing construction courses examined in this study may tend to be presented in an organized form so that structuring is not called for, and differences in the learning of field dependent and field independent students may not be apparent.

It was the intention of the researcher to compile a battery of tests suitable for predicting competency in clothing construction. The 1978 Revised Placement Test, currently in use at the University of Alberta, was determined to be the most useful measure. The additional measures, the Purdue Pegboard Test and the Embedded Figures Test, did not significantly improve the predictive ability of the test battery so were not considered as useful.

Recommendations

On the basis of this study, a number of recommendations for further research were formulated:

1. A placement test should continue to be administered to students entering Clothing Construction and the Basic Pattern, CL TX 203, at the University of Alberta. The form of this test and the content of the questions will be dependent on the structure and content of the course. A longitudinal study would be an appropriate way to monitor the predictive value of the placement test as course and test changes are made.
2. The development of a pretest based on the course Experimental Techniques in Clothing Construction, CL TX 307, at the University of Alberta, may prove valuable. An analysis of the results obtained from administration of such a pretest would enable instructors to tailor instruction to meet the students' needs, identify

students who are more familiar with the course material, and increase the students' awareness of gaps in their knowledge.

3. This study could be repeated during a term when a larger number of students are enrolled in the clothing construction courses, CL TX 203 and CL TX 307. With a larger sample size the results of the statistical analysis would be more meaningful.

4. When conducting research in the area of clothing construction, the measures of clothing construction skill should be considered carefully. In the present study the score for the practical construction projects was based on a single project in CL TX 203. It would be advisable to ensure that each measure is a composite of scores from several projects, including garments and samples. This would provide a more comprehensive and accurate measure of construction ability than is possible when only one project is used.

5. It may prove worthwhile to investigate other variables which may increase the amount of explained variability in competency in clothing construction. One measure to consider is an aiming test. Fleishman (1954) states that aiming has been defined as "the ability to perform quickly and precisely a series of accurately directed movements requiring eye-hand coordination" (p.450). Perhaps the ability measured by aiming tests would be involved in clothing construction. Other tests of manual

dexterity, in place of the Purdue Pegboard, could also be considered.

6. The development and administration of an experience questionnaire may provide valuable information regarding a student's previous knowledge and experience in clothing construction. Questions pertaining to activities which require finger dexterity and creativity could also be included. To evaluate the student's experience based on the questionnaire numerical values would have to be assigned to item responses. The most appropriate assigning of values would have to be decided on the basis of repeated analyses.

Bibliography

Alderman, E. Comparison of One-Trial and Three-Trial Purdue Pegboard Norms. Occupations, 1949, 27, 251-252.

Anastasi, A. Psychological Testing (4th ed.). New York: Macmillan, 1976.

Baer, A.M. Perception of Line and Design in Clothing. Unpublished doctoral dissertation. Utah State University, 1970.

Berry, J.C. The Revision and Development of a Clothing Pretest for Appraising Competencies of First Year Clothing Students. Unpublished master's thesis, Oklahoma State University, 1963.

Blum, M.L. & Naylor, J.C. Industrial Psychology: Its Theoretical and Social Functions. New York: Harper & Row, 1968.

Bourassa, G.L. & Guion, R.M. A Factorial Study of Dexterity Tests. Journal of Applied Psychology, 1959, 43, 199-204.

Burge, Sr.I. Prediction of Performance of Students in College Clothing Construction Courses. Unpublished doctoral dissertation, Iowa State Univeristy, 1974.

Caudill, C.B. The Development of a Pretest to Determine Previous Experience of College Women in Clothing Construction. Unpublished master's thesis, Ohio State Univeristy, 1968.

Chadderdon, H. Determining the Effectiveness of Teaching Home Economics. Home Economics Education Association, Washington, D.C., 1977.

Collins, M.H. A Pre-Test for Placement in Beginning Clothing Courses at Southern Illinois University. Unpublished master's thesis, Southern Illinois University, 1953.

Cronbach, L.J. How Can Instruction be Adapted to Individual Differences? in _Learning and Individual Differences_, R.M.Gagne (ed.). Columbus: Charles E. Merrill, 1967, 23-39.

Elliott, R. Interrelationships Among Measures of Field Dependence, Ability, and Personality Traits. _Journal of Abnormal and Social Psychology_, 1961, _63_, 27-36.

Epps, H.H. _Development of a Pretest to Predict Success in Basic Clothing Construction Course at Winthrop College_. Unpublished master's thesis, Winthrop College, 1972.

Evans, V. _Prediction of College Clothing Construction Achievement by Means of Mechanical Aptitude Tests and the Saddler Clothing Construction Test_. Unpublished master's thesis, Iowa State College, 1947.

Faterson, H.F. Articulateness of Experience: An Extension of the Field-Dependence-Independence Concept, in _Measurement in Personality and Cognition_. S.Messick & J. Ross (eds.). New York: John Wiley & Sons, 1962, 171-181.

Fleck, H. _Toward Better Teaching of Home Economics_ (2nd ed.). New York: Macmillan, 1974.

Fleishman, E.A. Testing for Psychomotor Abilities by Means of Apparatus Tests. _Psychological Bulletin_, 1953, _50_, 241-262.

Fleishman, E.A. Dimensional Analysis of Pyschomotor Abilities. _Journal of Experimental Psychology_, 1954, _48_, 437-454.

Fleishman, E.A. The Description and Prediction of Perceptual-Motor Skill Learning, in _Training Research and Education_. R.Glaser (ed.). Pittsburgh: University of Pittsburgh Press, 1962, 137-175.

Fleishman, E.A. Individual Differences and Motor Learning, in _Learning and Individual Differences_. R.M.Gagne (ed.). Columbus: Charles & Merrill, 1967, 165-191.

Fleishman, E.A. & Ellison, G.D. A Factor Analysis of Fine Manipulative Tests. Journal of Applied Psychology. 1962, 46, 96-105.

Fleishman, E.A. & Hempel, W.E. A Factor Analysis of Dexterity Tests. Personnel Psychology, 1954, 7, 15-32.

Gagne, R.M. & Fleishman, E.A. Psychology and Human Performance. New York: Henry Holt, 1959.

Glaser, R. & Nitko, A.J. Measurement in Learning and Instruction, in Educational Measurement (2nd ed.). R.L. Thorndike (ed.). Washington: American Council on Education, 1971, 625-670.

Goodenough, D.R. & Karp, S.A. Field Dependence and Intellectual Functioning. Journal of Abnormal and Social Psychology, 1961, 63, 241-246.

Gough, H.G. & Olton, R.M. Field Independence as Related to Normal Measures of Perceptual Performance and Cognitive Ability. Journal of Consulting and Clinical Psychology, 1972, 38, 338-342.

Goslin, D.A. The Search for Ability. New York: Russell Sage Foundation, 1963.

Gulliksen, H. Theory of Mental Tests. New York: John Wiley & Sons, 1950.

Hale, M.B. Analysis of the 1960 and 1961 Oregon State University Clothing Construction Placement Test. Unpublished master's thesis, Oregon State University, 1963.

Henson, M.A. Clothing Construction Placement Test for Students at the University of Arkansas College of Agriculture and Home Economics. Unpublished master's thesis, University of Arkansas, 1975.

Hoskins, M.N. Construction of a Basic Clothing Pretest for Use in the Colleges and Universities in New Mexico, Unpublished master's thesis, 1959.

Hunter, D.R. Development of an Enlisted Psychomotor/ Perceptual Test Battery, Final Report. Air Force Human Resources Lab, Lackland AFB, Texas, Personnel Research Division, 1975.

Inskeep, G.C. The Use of Psychomotor Tests to Select Sewing Machine Operators - Some Negative Findings. Personnel Psychology, 1971, 24, 707-714.

Jackson, D.N. A Short Form of Witkin's Embedded Figures Test. Journal of Abnormal and Social Psychology, 1956, 53, 254-255.

Kane, J. & Gill, R.P. Implications of the Purdue Pegboard as a Screening Device. Journal of Learning Disabilities, 1972, 5, 32-36.

Karp, S.A. Field Dependence and Overcoming Embeddedness. Journal of Consulting Psychology, 1963, 27, 294-302.

Kerlinger, F.N. Foundations of Behavioral Research (2nd ed.). New York: Holt, Rinehart and Winston, 1973.

Kernaleguen, A.P. Creativity Level, Perceptual Style and Peer Perception of Attitudes Towards Clothing. Unpublished doctoral dissertation, Utah State University, 1968.

Measuring Student Achievement in Home Economics. Bureau of Elementary and Secondary Educational Testing, New York State Education Department, Albany Bureau, 1975.

Nie, N.H., Hull, C.H., Jenkins, J.G., Steinbrenner, K., & Bent, D.H. Statistical Package for the Social Sciences (2nd ed.). New York: McGraw-Hill, 1975.

Nieman, M.R. Effectiveness of the Placement Test for Sectioning Students in the Elementary Clothing Construction Course. Unpublished master's thesis, Iowa State University of Science and Technology, 1961.

Purdue Pegboard Examiner Manual. Chicago: Science Research Associates, 1961.

Rim, Y. The Predictive Validity of Seven Manual Dexterity Tests. Psychologia, 1962, 5, 52-55.

Rothgarn, M.M. The Development of a Method of Pretesting Student Ability to Understand and Apply Principles of Clothing Construction. Unpublished master's thesis, Michigan State University, 1962.

Schmidt, R.A. Motor Skills. New York: Harper & Row, 1975.

Scholtes, M.C. Selection of a Test Battery for the Prediction of College Clothing Construction Achievement. Unpublished master's thesis, Iowa State College, 1948.

Schwarz, P.A. Prediction Instruments for Educational Outcomes, in Educational Measurement (2nd ed.). R.L.Thorndike (ed.). Washington, D.C.: American Council on Education, 1971, 303-331.

Semeniuk, A.O. & Galbraith, L.K. Pretesting Freshman Women Students to Determine Clothing Background. Journal of Home Economics, 1964, 56, 403-406.

Shaw, B.J. A Guide for Placement in University Clothing Construction Courses Based on Students' Knowledge. Unpublished master's thesis, Iowa State University, 1971.

Singer, R.N. Motor Learning and Human Performance (2nd ed.). New York: Macmillan, 1975.

Super, D.E. & Crites, J.O. Appraising Vocational Fitness. New York: Harper & Brothers, 1962.

Surgent, L.V. The Use of Aptitude Tests in the Selection of Radio Tube Mounters. Psychological Monographs, 1947, 61, No. 283.

Tiffin, J. & Asher, E.J. The Purdue Pegboard: Norms and Studies of Reliability and Validity. Journal of Applied Psychology, 1948, 32, 234-247.

Vernon, P.E. The Distinctiveness of Field Independence. Journal of Personality, 1972, 40, 366-391.

Walli, Sr. C.M. The Development of a Standardized Instrument for the Measurement of Achievement in Clothing Construction at the Senior High School Level. Unpublished master's thesis, Michigan State University, 1968.

Webster, R.M. Development and Investigation of Selected Evaluative Devices for Estimating Levels of Achievement of Students Enrolled in Clothing I, School of Home Science, University of Otago, Dunedin, New Zealand. Unpublished master's thesis, University of Tennessee, 1969.

Witkin, H.A. Individual Differences in Ease of Perception of Embedded Figures. Journal of Personality, 1950, 19, 1-15.

Witkin, H.A., Dyk, R.B., Faterson, H.F., Goodenough, D.R., & Karp, S.A. Psychological Differentiation. New York: John Wiley & Sons, 1962.

Witkin, H.A. & Goodenough, D.R. Field Dependence and Interpersonal Behavior. Psychological Bulletin, 1977, 84, 661-689.

Witkin H.A., Lewis, H.B., Hertzman, M., Machover, K., Meissner, P.B., & Wapner, S. Personality Through Perception. New York: Harper & Brothers, 1954.

Witkin, H.A., Moore, C.A., Goodenough, D.R., & Cox, P.W. Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications. Review of Educational Research, 1977a, 47, 1-64.

Witkin, H.A., Moore, C.A., Oltman, P.K., Goodenough, D.K., Friedman, F., Owen, D.R., & Raskin, E. Role of the Field-Dependent and Field-Independent Cognitive Styles in Academic Evolution: A Longitudinal Study. Journal of Educational Pychology, 1977b, 69, 197-211.

Witkin, H.A., Oltman, P.K., Raskin, E., & Karp, S.A. A Manual for the Embedded Figures Test. Palo Alto, California: Consulting Psychologists Press, 1971.

Wright, J.S. & Henkel, J. Achievement in Clothing Construction. Journal of Home Economics, 1951, 43, 626-628.