THE DEVELOPMENT OF
A CLOTHING CONSTRUCTION EXEMPTION TEST

by

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Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fullfilment of the requirements for the degree of

MASTER OF SCIENCE

in

Clothing and Textiles

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June, 1984

Blacksburg, Virginia

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(ABSTRACT)

This research was conducted over the period of three quarters at Virginia Tech. The goal was to develop an instrument that was both valid and reliable for the purpose of exempting qualified, experienced students from the basic apparel construction course and allow them to begin with the advanced course. Resulting classes would be more homogeneous and, therefore, could be more effectively taught.

Data on test questions was available from prior administrations of a clothing construction knowledge test. Test items that pertained to current course content and with acceptable difficulty and discrimination indexes were retained for use. The test was developed in three phases.

The resulting test would be adaptable for use by other institutions because of the methodology used to develope it. The course behavioral objectives were first examined and assigned a percentage corresponding to the amount of class time devoted to each objective. Individual learning concepts were then analyzed and listed under the objective

they each pertained to. Once this categorization was accomplished, the learning concepts were each ranked according to importance and complexity within their respective objectives. This ranking was then used to decide how many test items should pertain to each concept.

The exemption test developed through this procedure encompassed all course objectives and assured a representative sample of the course content. The final test was determined to be both valid and reliable. Its adoption as an exemption test was recommended with minor revision.

ACKNOWLEDGEMENTS

I wish to express my deepest appreciation to Dr. Lois M. Gurel, my chairman and thesis director. Her guidance, inspiration, and understanding have been invaluable. She has guided me with the determination of an advisor and the gentleness of a friend. I shall always treasure her friendship.

To my other committee members, Dr. Dennis Hinkle, Dr. Mary Helen Marshall, and Ms. Carol Ann Honeycutt, I owe a special thanks. They have all made significant contributions in both time and direction. I also wish to acknowledge Dr. Carolyn Moore, my friend and teacher, who assisted in the collection of data and whose students so cheerfully participated in this study. Thanks also go the Missy Kersch, a fellow graduate student, who gave me moral support whenever I needed it.

Finally, I wish to express my appreciation to my husband Bruce and our children Julie, Ross, and Robert. Without their total support, personal sacrifices, and love I would never have undertaken this step in life, much less completed it.

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CHAPTER I

INTRODUCTION

Education is defined by Webster (1981) as "the knowledge and development resulting from an educational process." It is the change in skill level and comprehension that results from exposure to new materials. In order for education to be effective it must add to the knowledge the student already possesses. Although repetition reinforces learning, once a competency level has been achieved, repetitious learnings serve no further purpose. Because of the many demands on a student's time, an unfavorable attitude may even be created towards the subject. In light of this, educators are constantly striving to improve the quality of education available to students attending institutions of higher learning. They want to provide the best possible opportunity for growth and development of the individual student (Goslin, 1963).

One of the reasons the movement towards competency based education is becoming more prevalent is the emphasis on results. This movement emphasizes the specific knowledge and skills to be mastered rather than how they are learned. It is flexible and its standards are clearly articulated (Parnell, 1978). Proponents believe that students will benefit if educators incorporate competency based education

principles into the curriculum. They also believe that by concentrating on students' individual achievements rather than making them fit into pre-designed programs that do not recognize any individual differences or skills, educators will better serve the needs of the students.

Students enter all classroom instruction with varied previous experiences. The degree of skill, knowledge, background, and interest in clothing construction varies greatly at the college level due to the variation in quality and quantity of clothing construction experience the student has had. As a result, some students have a lot more ground to cover to reach competency levels than do others (Cross, 1973). In order for the courses to be stimulating to the individual students, they should be at a level that is challenging. Bishop (1971) believed that

> Conventional educational programs are inadequate and obsolete when we consider the diversity of skill, conceptual development, attitudes and values, and capabilities required and rightfully demanded by students for survival in our complex, technological society. (p.ix)

The practice of homogeneous grouping on the basis of ability also maximizes teaching efficiency (Goslin, 1963).

Sewing is a skill composed of individual competencies. Burns (1973b) described competency as being "synonomous with the concept of ability" (p. 42). A well made garment is the result of a series of these mastered competencies. The individual skills that make up each competency can be

tested. If a student can be shown to possess the competencies encompassed in an introductory sewing course then that student should be starting at a more advanced level if she/he is to be challenged. Although the capable students need additional challenges, those with little or no background knowledge are at a disadvantage when trying to keep up with the scheduled class progress and may need extra attention from the instructor. A method of evaluation is necessary in order to determine the skill level of the student.

The clothing construction course sequence at Virginia Polytechnic Institute and State University (Virginia Tech) has recently been changed from two courses to a three part series. The first course, Basic Apparel Construction, (CT 2401) contains basic construction learnings. The second course, Advanced Apparel Construction and Fitting, (CT 2402) is composed of alteration and fitting principles and advanced construction techniques. The third course, Flat Pattern and Design, (CT 2403) covers beginning flat pattern designing and construction of a personal design. These will be referred to as CT 2401, CT 2402, and CT 2403, respectively, throughout the remainder of this study.

The goal of this research was to find a satisfactory method of pre-determining the student's level of competency on the construction skills that are taught in CT 2401. To do this the objectives of CT 2401 were examined. The

university approved syllabus describes Clothing and Textiles 2401, Basic Apparel Construction, as " Basic principles of apparel construction. Application of basic construction techniques to fabrics which differ in fiber content, fabric structure, and design." The educational objectives state that at the conclusion of this course the student will be able to:

1. Demonstrate a knowledge of the relationships between fiber type, fabric construction, design selection, and end use of the garment.
2. Demonstrate an understanding of pattern and fabric preparation through appropriate application.
3. Demonstrate a knowledge of appropriate layout concepts and proper techniques for cutting and marking garment sections.
4. Demonstrate knowledge of basic concepts of sewing machine usuage.
5. Understand the garment assembly process and demonstrate an understanding of and excellence in construction skills.
6. Understand beginning concepts of fit and demonstrate ability to achieve elementary levels of fit.

These objectives, as carried out by the course content, served as the basis for student evaluation.

One widely used method of evaluation is the pretest. Pretesting for the purpose of placement is not the same as competency based education but its underlying principles are the same. The common goal is to have students working at a pace that is comfortable yet challenging for them. Several universities have developed pretests that determine the student's level of achievement in clothing construction for the purpose of placement and exemption (Souligny and Sisler 1972). This is not a new concept. Hale (1963) stated that the first such test at Oregon State University was developed in the early 1930's. Saddler developed a placement test in 1945 for Iowa State University (Hale, 1963).

In addition to evaluating previous experience in clothing construction, the pretest enables the instructor to become familiar with the capabilities of individual students and thereby determine the level at which instruction should begin. It also helps the teacher know when to give encouragement to less experienced students and when to challenge capable students (Semeniuk and Galbraith, 1964). Another function of the pretest is that it also arouses the interest of the students by giving them a preview of the course learnings (Marshall, 1967). Semeniuk (1964) also found that as a result of pretesting, ". . . the students were made aware of the gaps in their knowledge, which created a more favorable attitude toward the course and made them more receptive to the subject matter presented" (p. 406).

Although many studies have been reported in journal articles and theses, they point out that pretests must be specifically designed according to the objectives of the course for which they are used. Most published pretests are from the 1960's and early 1970's, and therefore, do not necessarily encompass up-to-date techniques. At a time when the university curriculum is becoming increasingly crowded and demands on students' time are numerous, careful analysis of degree requirements is imperative. An evaluative placement test could be used to exempt qualified students from repetitious learning experiences and, thereby, free credit hours for new learnings. Therefore, this researcher will developed a pretest based on the objectives of CT 2401, that can be used to exempt competent students from the beginning course of the clothing construction series. It is also the hope of this researcher that, as a result of this test, instructors of CT 2401 will be able to assess the needs of the students and plan meaningful experiences for each, based on individual capabilities.

CHAPTER II

REVIEW OF LITERATURE

The review of literature is concerned with the concept of placement tests and their development. The usefulness of placement tests is apparent when considering the diversified backgrounds of students entering basic level courses.

A portion of the students who enter the clothing and textiles field at the college level will do so with an extensive background in home sewing. In a study on home sewing by adolescents, Koontz (1981) noted that students who learned how to sew as children were more likely to become active sewers as they grew older. Hobbs (1970) did a study of clothing acquisition patterns of 191 adolescent girl and found that over 21% wore mostly home-made clothes. However, Koontz also noted that in high school home economics classes there was a national trend to de-emphasize teaching clothing construction and stress consumer education instead. As a result, entering students, depending upon where they went to high school, may range from having little or no background to having extensive experience in clothing construction. Semmeniuk (1961) observed that placing students with all levels of experience in the same group did not encourage the students with weaker backgrounds to learn anymore than it motivated or challenged the experienced student to excel.

The concept of exempting students with extensive background in a subject area is practiced by some departments at Virginia Tech. The Mathematics Department has a policy to exempt students from one beginning course based on high school experience (number of math courses taken) and grades received in high school math. The beginning course in another series may be exempted either by the above policy or by taking an advanced placement test. If these exemptions are based on experience and grades then credit is given for the beginning course only if a grade of C- or better is achieved in the second course. Credit is automatically given if exemption is based on the advanced placement test. The Math Department allows credit by examination in three of its first year courses. (Riess, 1983). The English Department at Virginia Tech also has a policy for exempting well qualified students from its beginning courses.

Beginning clothing construction like beginning math and English courses is a skill oriented course. In reporting on the value of evaluative testing for college home economics programs, Arny (1949), then chairman of the American Home Economics Association evaluation committee, wrote

> Progressive colleges will undoubtedly develop plans by means of which these students [with extensive background experience] can be exempted from some of the elementary courses in home economics. (p. 16)

One widely used method of placing students is evaluation

through pretesting to determine the level of competency. Accordingly, the review of literature for this study will be divided into three major topics: Evaluation and Testing, Test Construction, and Clothing Construction Pretests.

Evaluation and Testing

Cross (1973) defined evaluation as "A process which determines the extent to which objectives have been achieved." A key concept in this definition is the relationship of objectives to evaluation. Cross also stated that the major purpose of evaluation is to determine whether or not the objective has been met.

Evaluation and educational accountability are closely related. The trend for educational accountability began in the late sixties. Proponents emphasized the need for schools to be effective. Evidence of this is the number of states that enacted laws in the late 1970's requiring high school students to demonstrate minimum competencies in basic skills before being granted a high school diploma (Popham, 1981). The statement of objectives gives a specific set of goals to be completed. Burns (1973b, p.46) listed four uses of objectives: they are a written record of what is to be achieved, they tell the student what he should be able to do at the end of the learning session, they help in planning appropriate classroom learning experiences, and they are a guide to effective evaluation techniques. Cross said the

procedure for evaluation should be appropriate to the type of objectives. The objectives must be kept clearly in mind when planning the type of evaluation. Past experiences and varying abilities of students also influence how evaluation data are interpreted (Cross, 1973).

Assessment of an individual's level of performance requires using a method of evaluation. The educational system could not be divided and sequenced without evaluation. To progress, the student must go from one stage to the next and evaluation is necessary to determine when each stage has been satisfactorily completed. Authorities agree that measuring a student's performance before a class as well as after plays a crucial role in evaluation (Klingsted, 1973a; Cross, 1973; Popham, 1981).

Effective learning is dependent upon meeting specified criteria during the educational process. Burns (1973a) described criteria in competency based education as "performance to some standard" (p.92). The list of objectives is often the basis of that standard. "Objectives are descriptions, in behavioral terms, of what the learner is able to do at the end of any instructional period" (Burns, 1973b, p. 42). Achievement of those objectives is the criteria of successful completion of the course.

Popham (1981) predicted the continuing emphasis on evaluation in education for many years. Cross (1973) summed up the importance of evaluation in the following statement.

> Evaluation of student abilities dictates learning experiences and may include such methods as pretests and demonstrations to determine previously acquired knowledge and skills. In addition, study of student records [background experience] may reveal much about abilities of students and make it possible for the teacher to gear learning experiences to desirable levels, to help some students catch up, to provide challenges for the more able students, and to determine the standards. (p. 10)

Goslin (1963) pointed out that the growing concern for education in America has led to an increased use of tests that measure ability as a method of classifying students. Popham (1981) reported that the most frequent uses of tests have been to assess individual students in order to make instructional decisions about them. Even though the tests are administered to an entire group at one time, they are employed to make individual decisions about individual students (Popham, 1981). The success of classification based on competencies depends upon adequate assessment techniques.

According to Anastasi (1972a) tests show what a person can do at a given point in time, but do not give any indication as to how that level was achieved. She recommended that test scores not be interpreted in a vacuum but that background information be investigated to enable better evaluation. The use of an experience questionnaire along with an ability test would provide added information to the evaluator.

Achievement is measurable when it makes a difference in what a person can or does do in a classroom situation (Ebel,

1972). Saying it is measurable presents the problem of how to measure it. Evaluation tests used in comparable circumstances (such as other placement tests in similar courses) can be reviewed but if none exists that fit the course objectives then one must be constructed. Ebel (1972) believed that the individual teachers should prepare the tests used in their classroom. Although published tests from other sources are often comprehensive, they generally do not measure the specific objectives set forth for a course.

Two major forms of tests are the essay test and the objective test. The essay tests requires that students express themselves in their own words, drawing on the knowledge they possess. The number of questions must be limited in order to allow sufficient time for answering. The objective test requires the student to select or recognize the right answer. This form provides a means for the instructor to observe an extensive sample of student behavior under carefully controlled conditions. The objective test requires less time to answer each question, therefore, a greater representative sample of material from the course content can be included. Generally the larger the number of questions, the greater the reliability (Ebel, 1972).

Scoring essay and objective tests differs also. On the essay test, scoring is subjective; it is based on the values of the evaluator. Human bias and opinions differ from one

instructor to another, therefore, over a period of time, results would not be as reliable as on objective tests (Educational Testing Service [ETS], 1973). Carefully constructed objective tests have one right answer that is not dependent on the opinion of the evaluator. Therefore, they are more precise in measurement than essay tests (Cross, 1973).

The level of difficulty of a test is a function of its purpose. Ashworth (1982) reported that if the purpose of a test is to select outstanding students then questions must be difficult. Most students would get low scores. Only the extremely competent would do well. One problem with this type of test is that unless the purpose of the test is quite clear, low scores could be depressing to the majority of the students. If the goal is to identify those who need remedial work, questions should be quite easy so that the majority of the students get answers right. Those who score low then are lacking in basic knowledge of the subject.

Tests have a different function in competency based education. Instead of being scored on a curve, which is often done in the traditional classroom, a minimum level of competency (possibly a score on an evaluative test) is set and a student must reach that level if he/she is to pass on to the next stage (Klingstedt, 1973b).

Pretesting is yet another use of tests. Spafford (1949) felt that pretesting is an often neglected area of

evaluation. She listed several advantages of using pretests. They are a means of avoiding repetition and identifying gaps in the students' knowledge. Pretests can show the kind and amount of previous experience, provide a basis for planning programs that meet the needs of the individual students, motivate students by previewing the learnings necessary to achieve the objectives, and, finally, they show how progress can be measured (p. 218-219).

Test Construction

One of the values of a pretest is its use as a diagnostic tool. To be useful the test must be constructed in such a way as to clearly cover the content of the course it is used with. The questions must be written clearly so they are not easily misunderstood by the test taker. Information from the test may be used to identify the needs of the students. If the test is comprehensive students also acquire an overview of the course content. Thought and care must be given to test construction if the pretest is to be effective.

Test scores are generally indicative of the ability and knowledge of the person taking the tests, however, they are also affected by any inaccuracies in the test itself (Doppelt, 1972). In order to make a test as accurate as possible there are basic guidelines to follow when constructing the test. Cross (1973, p. 81) listed six steps

for constructing and using paper and pencil tests.

1. Identify the objectives that can and should be evaluated.
2. List the subject matter content the test should cover.
3. Develop a grid or table of specifications that indicates the percent of test items for each objective and content area.
4. Select or construct individual test items and arrange these into a test.
5. Administer the test.
6. Analyze the results.

Ashworth (1982) agreed except that in addition to these steps he also included the concepts of trying out the test on a group of students similar to those it is designed for, checking the time allotted, and analyzing the results for reliability, validity, and distribution before using it on the actual class.

Although there are no set rules as to when to use essay questions and when to use objective questions, the test situation often is more suitable to one type than the other. When using tests for the purpose of placement, objective tests have the following advantages: they measure knowledge of facts efficiently, they can contain a great many test items and cover a broad area of knowledge and abilities, they can be scored very quickly, and the scoring is accurate

and consistent (ETS, 1973). Objective tests can cover almost any area of content, and, well constructed questions are usually quite discriminating (Hatcher and Halchin, 1973). The disadvantages are preparation time and "give-away" answers (ETS, 1973). Because they require a large number of questions, the preparation time may be great. Also, it is very difficult to provide detractors that are all plausable rather than having only one answer that is obviously right. Although the objective test format allows guessing, good test construction can minimize this problem (Cross, 1973). Regardless of the type of test, the reliability, validity, and usability must be considered.

Reliability (which can be measured statistically) is concerned with the accuracy of the test (Leedy, 1980). A reliable test gives the same results everytime it is used and it reflects the "true" ability of the subject. According to Ebel (1972) the more variability in the test scores, the higher the reliability of the test. This is because errors of measurement become less significant as the variability increases. The error of measurement is the statistical estimation of the difference between the obtained score (measurement of ability) on a test and the subject's actual or "true" ability level (Adkins, 1974). Difficulty and discrimination of test items are factors in the variability of scores. Increasing the number of questions (Ebel, 1972) as well as adequate sampling of all aspects of the course

increases the reliability (Cross, 1973). Clear directions increase reliability. A test with too many types of questions reduces reliability because a new set of directions is required for each type (Cross, 1973). Ebel (1972) pointed out that objective tests are often more reliable than essay tests because objective tests make it easier to include a representative sample and because scoring is more uniform.

Validity is concerned with the effectiveness of the test (Leedy, 1980); whether or not the test measures what it is supposed to measure. Validity asks the question "What does the test measure, and how well does it measure it?" (Leedy, 1980). A test is valid if it measures all of and only what it claims to measure (Anastasi (1972b). A test that contains a broad representative sample of the course content will have a high degree of content validity (Ahmann and Glock, 1975). The most important of all test characteristics, validity is of utmost importance when measuring achievement (Cross, 1973). It is generally accepted that if a test has demonstrated validity, reliability is secondary. A test can be reliable without being valid; it can always lead to the same wrong conclusion.

The validity of a test can be measured statistically ". . . usually . . . by correlating a group's test scores with measures of the subsequent performance of the

individuals in the criterion situation" (Goslin, 1963, p. 154). A criterion situation such as a posttest or the final grades in the course would be a measure of the tests predictive ability. High predictive validity against a specific criterion is necessary if the test is to assess adequately a student's future performance (Anastasi, 1972a).

Regardless of how the test is constructed, it must be usable. Usability involves administration, scoring, cost, and practicality. The test should be easy to administer, with clear, concise directions. Scoring should be easy and interpretation of scores should be easily understood. The cost of using the test should be reasonable. All of these contribute to the practicality of a test (Cross, 1973).

Clothing Construction Pretests

The use of pretests or evaluative devices has been the subject of several studies. Most of these evaluated knowledge and background experience but the purposes and test forms varied. A review of these studies is important in order to determine what other colleges and universities found to be successful.

Semeniuk (1961) conducted a study at South Dakota State College of Agriculture and Mechanical Arts. She developed a pretest based on the content and objectives of the beginning clothing construction course at that institution. The purposes of the pretest and questionnaire were to determine

strengths and weaknesses of students in order to structure the course to their needs, to preview the course, and possibly to assign the students to sections based on ability.

The pretest contained 116 true-false and multiple choice items that tested for both knowledge of facts and application of principles. The test questions were grouped into five areas and each group was scored separately as well as all groups collectively. Accompanying the pretest was a questionnaire asking for background experiences and attitudes towards sewing. Both were administered in two successive quarters to students taking the course. Semeniuk felt that the pretest enabled students to identify their own weaknesses and thereby improve their attitudes towards the course. The instructor was also able to identify those students who needed extra help as well as those who required extra challenges. An attitude questionnaire at the end of the course showed that nearly all the students felt the course was at the right level for them. Little relationship was found between experience and the pretest score but she did find that scores on the posttest were significantly higher than those on the pretest.

Analysis showed the pretest to be of only average difficulty, discrimination, reliability, and validity. As a result, Semeniuk recommended that another test, such as a

practical one, be used in conjunction with the written test for classifying students.

Oregon State University first used a pretest in the early 1930's for the purpose of exempting students from the beginning clothing construction course (Hale, 1963). The test was revised almost yearly as the content and emphasis of the course changed. The study undertaken by Hale (1963) was done to determine the effectiveness and usefulness of this testing program. A questionnaire was developed to determine the students awareness and opinion of their own placement. Instructors were also questioned as to the accuracy of placement of the students.

Hale first gave the placement test to 427 subjects, then a retest and questionnaire were given to 104 of those students. Analysis showed that the data obtained by use of the placement test were not available through other sources of data such as ACT scores or class rank which are normally available for incoming students. Although there was some correlation between the test score and the final grade, the addition of the California Test Bureau's Survey of Object Visualization Test (which tests a person's ability to visualize a complete object from viewing its parts) gave a higher correlation with the final grade. The questionnaire showed that students were generally not aware of the significance of the placement test. Instructors, however, believed that individual student placements had worked well.

Hale stated that reliability and validity coefficients were not high enough to use the test by itself as a tool for exemption. She recommended that until revisions were made, the Survey of Object Visualization test should be used in conjunction with the pretest.

In a study at Washington State University, McDonald (1964) attempted to validate two instruments she developed for the purpose of predicting success in beginning clothing construction. One instrument was a written test and the other a dress rating scale. They were designed to allow the students to "challenge" the beginning clothing construction course after taking the first half of the course by making a garment. If they passed the challenge, they could then waive the second half. The course was set up so that principles of construction were taught the first half semester and application of those principles the second half. The written test was given to 36 students enrolled in the beginning clothing construction course. Those who scored in the upper quarter were permitted to make a challenge dress if they so chose. The dress was then scored using a rating scale developed by McDonald.

After analyzing the results, McDonald concluded that the reliability and valididy were not high enough for the tests to be used in their present form. The instrument needed an increase in item difficulty to be used as a basis for waiving the course. She found the rating scale for the

dress to be a better predictor than the written tests but recommended that both be revised before implementation.

The University of Tennessee had been using a pretest in beginning clothing construction for several years when Marshall (1967) conducted her research. The purpose of her study was to develop a written pretest that would more adequately identify the knowledge and skills of the incoming students. The scores on the pretest were used to determine which students should be required to attend extra laboratory sessions. Marshall also investigated the relationship of American College Test (ACT) scores, past experiences, reading scores, and object visualization scores with the level of success in beginning clothing construction courses. A performance test was not used because of time required for administration. The study was conducted with 70 students during two successive quarters. The instrument was then revised after the discrimination power and difficulty index were calculated and the test was then given to students the following quarter.

The written pretest was composed of 100 objective items. In addition, students were asked to assess their own abilities and were assigned an experience index based on this assessment. They were also given the Nelson-Denney Reading Test and the California Test Bureau's Survey of Object Visualization test. ACT sores were obtained through university records. Analysis of the data showed that

correlation between the pretest and the other evaluative measures was significant at the .01 level for the experience index and the Survey of Object Visualization but not for the Nelson-Denney Reading Test or the ACT scores. As a result of the study Marshall concluded that

> ...it becomes increasingly apparent that more work needs to be done in the area of pretesting as college curricula change and enrollments increase. Only through an accurate assessment of the potentialities of students can college clothing courses be made meaningful for all students. (p. 55)

Currently, The University of Tennessee (DeJonge, 1984) is using both a written and practical exam, the written one is a revision of previous tests. Students are not required to take the exam although about 25 percent do and about ten percent pass and exempt the first construction course.

Working at Winthrop College, Epps (1972) developed an evaluative device in order to individualize instruction for students in the basic clothing construction course. The pretest, a practical performance test, and an experience questionnaire were administered to 54 students during two consecutive semesters. Both the practical pretest scores and the levels of experience were significantly related to the written pretest score, as were the course grades.

Because the practical pretest and the experience questionnaire were highly correlated with the written pretest, she recommended they be eliminated. Since they were all providing the same information, only one was

necessary. She concluded that the written pretest was a valid predictive measure which could be used to plan individualized instruction.

The placement test at The Ohio State University was evaluated and revised in 1979 as the result of a study by LaFrenz (1979). The last revision had been in 1971. Changes in course content, a lack of analysis for reliability and validity, results of continuing item analysis, the increased number of male subjects, and the imminent change to the metric system all contributed to the need for revision. Records of test scores and item analysis were available from the score sheets of 547 students who had taken the test during the previous three years.

Course content was evaluated by developing a table of specifications listing content areas and subject matter covered in the basic clothing construction course. Individual test items were then classified as to the areas they were testing. They were also categorized as to whether they were knowledge oriented, comprehension oriented, or application oriented, according to Bloom's "Taxonomy of Educational Objectives." Major changes in content were then geared towards higher levels of cognitive domain. Item analysis was used to select or revise questions in order to achieve desirable levels of difficulty and discrimination.

The resulting 76 item list was administered to 52 students. The mean was 39.46 with a standard deviation of

9.90. The range of scores was 55-33. LaFrenz concluded that the test had a good distribution of items with varying difficulty. The reliability of the revised test as measured by Kuder-Richardson 20 improved over the previous test. Item analysis showed that 87 percent of the 76 items fell in the desirable difficulty range with only three items being too easy. The mean discrimination power increased on the revised test although some individual items were below the desired level. In order to maintain an effective evaluation instrument, LaFrenz recommended that the item analysis be reviewed as often as necessary to replace items that did not discriminate and that the test be checked periodically for content validity.

Currently, the test is being used with a revision of seven questions (LaFrenz, 1983). All students except those with transfer credit are required to take it and those scoring 40 or above may exempt the beginning clothing construction course. Those with scores between 39-36 may take a practical test for further discrimination towards exemption.

Correspondance with several other universities provided information about their current testing programs. New Mexico State University (Matern, 1984) uses a multiple choice test and allows students scoring 80 percent or better to exempt a one hour, elective, self paced course. Students are given credit on the Satisfactory/Unsatisfactory basis.

Their other basic clothing construction course is designed for home economics education majors and includes teaching methods as well as construction techniques, therefore, it is not subject to exemption.

A placement test which allows qualified students to exempt the beginning clothing construction course is used by Auburn University (Weaver, 1984). The test is optional and involves a written exam which includes half-scale pattern alterations and a practical exam. The entire test takes four to five hours to complete. Students scoring 68 percent on both sections of the test may exempt. They do not receive credit and must substitute another clothing related course. Weaver indicated that most students elect to take the construction course. She reported that the major hazard in offering a placement test is that some students may use it to avoid scheduling problems or to avoid the class even if they can't sew rather than for the intended purpose.

Purdue University (Rupel, 1984) uses an exemption test containing 85 objective items which takes about 40 minutes to complete. A score of 88 percent or better allows the student to exempt the one hour beginning course. Students who exempt do not receive credit but do fulfill the prerequisite for taking advanced design courses. Apparel design majors do not have the option of exempting because they are required to take a different two hour beginning construction course. Purdue University listed several

reasons for not using a pratical test: excessive staff time required, scheduling conflicts, available laboratory space for required amount of time, expense of materials, and variability of evaluators.

Oklahoma State University (Sisler, 1983) has divided its basic construction course into seven, one credit modules. Students may currently test out of module one by taking an exam which is interactive computer generated. The exam consists of 100 items randomly selected from a large pool pertaining specifically to the content of module one. Students "pass" with a C or better and receive one credit with a grade of "Pass". A practical exam is no longer used for the following reasons: expense, time involved, and difficulty of administration. Also, after several years of research they found it was extremely rare for anyone who had passed the written exam not to pass the practical exam.

Winthroop College (Randolph, 1983) uses a written test to allow students to test out of their basic construction course with three hours credit. Students are not required to take the test and those who do may take it only once. They no longer use a practical test because of the high correlation between written and practical test scores.

The beginning construction course at Oregon State University (Koester, 1984) is divided into seven modules and one of two alternate test forms is given covering all the modules. Students are given seven separate grades on the

test, one for each group of questions covering each module. Thus a student may test out of any module with a score of 85 percent or better on that portion of the test. Students are not required to take the test but all are asked to. Not taking it means the student must complete all seven modules during the course. No practical test is used.

Southern Illinois University (Grise, 1984) uses a combination of written and practical testing as a proficiency exam. The students first take a written exam and then must pass a practical exam which tests specific skills on half scale items. They must also bring in garments they have made and be evaluated as to construction and fit. Those with 68 percent or better on the written exam and a passing score on the practical receive two hours credit. Students who make 80 percent or better may take an additional part of the practical for three hours credit. All credit is recorded as "Pass" rather than a grade. The proficiency exam may be taken only once.

Summary

Although much research has been conducted on the problem of test evaluation for clothing construction courses, no definitive test exists. Many that have been developed were done ten or more years ago. Both techniques and terminology in the construction field change with time. Fibers, fabrics, and findings as well as methods have

changed. A suitable test must take these changes into consideration. Additionally, research as well as observation indicates that a test is most applicable if it is developed for a specific course, using course objectives as guidelines.

The purpose of this research, then, was to develop an evaluative test based on CT 2401 course objectives. This test was designed to measure the competencies that are taught in CT 2401 and would be suitable for use as an exemption test. The objective test form was used because it allowed greater representation of course content and more consistant scoring.

CHAPTER III

STATEMENT OF THE PROBLEM

Students enter a beginning level clothing construction course with a variety of skills, knowledge, and background experiences. In order for a course to be challenging and meaningful to all participants, it must be at a level that is not overly repetitious of previous learnings. When students possessing considerable sewing skills are in the same learning situation as novices, the needs of one or the other will not be fully met. Since CT 2401 is a basic sewing course, it is designed to teach elementary learnings. Therefore, it may be repetitious to more advanced students and fail to challenge them. At present, there is no method of separating novice and experienced students in the clothing construction program at Virginia Tech.

Purpose

The purpose of this study was to develop a written pretest to assesses the level of skills and experience of students enrolled in Clothing and Textiles 2401: Basic Apparel Construction. This test was developed for the primary purpose of exempting exceptionally well qualified students from taking CT 2401 and allowing them to proceed directly to CT 2402.

Objective

The objective of this research was to develop a written pretest for use in CT 2401 that demonstrates content validity and reliability. The test was developed based on course objectives and it contains items that measure the attainment of each of the objectives. Individual test items with acceptable levels of discrimination and difficulty were selected. Possible uses of the resulting test are:

1. To exempt exceptionally well qualified students from CT 2401 and allow them to progress directly to CT 2402.
2. To determine both individual and group experience and skills in order to structure the class to the needs of the students.
3. To identify those students who may need extra help.
4. To identify those students who have enough experience and skills to be student lab helpers during the laboratory periods.
5. To arouse the interest of the students by previewing the course content.
6. To evaluate the level of clothing construction competency of students transfering from other institutions.

Limitations

Due to the small size of individual classes, there may

be very few or even no students who score high enough to qualify for exemption in any given quarter. Further revisions may, therefore, be necessary after analyzing the test results from several successive quarters.

Although a performance test would verify the written test, its use is not practical because of the time frame for students taking the test and the objectivity of various people who would be grading it from quarter to quarter. The experience scale that accompanies the test is based on self-appraisal and therefore is subjective rather than objective.

The specific pretest developed is valid only for CT 2401 and may require revision to be useful for courses at other institutions because it is based on the content of Basic Apparel Construction at Virginia Tech.

Assumptions

This researcher made the following assumptions at the beginning of this study:

1. That students enter the beginning clothing construction course with varied levels of skill and experience.
2. That a written test can effectively measure the skill levels of incoming students.
3. That students will give an honest self-appraisal of previous instruction and experience.

CHAPTER IV

PROCEDURE

This research involved the development of an apparel construction pretest for use as an exemption test with CT 2401: Basic Apparel Construction. The procedure used to develop this test is presented in the following four sections entitled: Instruments, Sample, Administration, and Analysis of Data.

Instruments

The general plan was to test possible questions on students entering the basic course as well as on those who had completed it. Faculty input as well as item analysis of the questions were to be considered when selecting items for the expemption test. Content validity was the major criterion for choosing subject matter and the item analysis the major criterion for choosing individual test items. In addition to the mean and standard deviation, the computer printout of the test analyses provided three essential items of information: difficulty level and discrimination power of each question and the reliability estimate for the entire test.

The difficulty of a test item is indicated by the proportion of students who get the item right (Adkins,

1974). It is expressed as the proportion per hundred but can easily be converted to percentage. Knowing the difficulty of each item allows individual evaluation. Choosing specific items within a desirable range then allows control over the difficulty of the test as a whole. A difficulty level of less than .70 for each test item was desired. This level was lower than that used in regular testing because of the purpose of the test.

The discrimination power of an item refers to its ability to differentiate between good and poor students (Ahmann and Glock, 1975). An item is discriminating when better students get it right and poorer students do not. The discrimination power is expressed as the correlation of choices on the question with the total score on the test (Learning Resources Center (LRC), 1980). It is useful both for selecting test items that discriminate and for isolating questions that may be misleading. A negative correlation would show that the better students tended to miss that particular item. A discrimination index of .30 to .50 was desired. This high correlation is beneficial in showing that the question is actually indicating the students with higher levels of knowledge.

An estimate of reliability that is appropriate for tests where items have similar content is the Knuder-Richardson 20 (KR-20) procedure. Lemke and Wiersma (1976, p. 100) state that "As a measure of internal consistency,

the KR-20 formula is widely accepted and almost synonymous with reliability." It is based on the correlation of split-halves. That is, the test is divided in half and each half is scored separately, then the two scores are correlated. The KR-20 is the average of all possible split-half estimates and has the advantage of estimating reliability based on the single administration of a single test (Ahmann and Glock, 1975). The reliability coefficient should be a minimum of .800 if important decisions concerning students are to be based on test results (LRC, 1980). A test that demonstrates good internal consistency is considered reliable.

The researach was conducted in three phases (Appendix A). Phase one included the work done during Fall Quarter 1983, phase two was conducted Winter quarter 1984, and phase three involved the administration of the final form of the test during Spring Quaarter 1984. Although tests from several colleges were reviewed for content and form, the clothing construction pretest developed by Marshall (1967) at the University of Tennessee was the major basis for the instrument. It had been previously used by the clothing construction staff at Virginia Tech as a pretest in the beginning apparel construction course in order to determine strengths and weaknesses of individual students and to help in the selection of student lab helpers. The test contained 102 items covering the major portion of CT 2401 course

content, and data on question difficulty and discrimination was available.

An experience questionnaire (Appendix C) was developed for use with the instrument during its developmental stages. It was administered with the pretest for each phase. The general format of the experience questionnaire used by Marshall (1967) was followed. Necessary background information was ascertained in the first part. The list of construction practices included on the Marashall instrument was revised to reflect the content area of CT 2401. A rating scale based on competency in each area was used to establish the index. Students were asked to check one of three levels for each area. They were given three points for each area they felt individually competent in (Column A), two points for those areas that were familiar but required assistance (Column B), and one point for areas never attempted before (Column C). The purpose of the resulting experience index was to help determine the validity of the test by showing the relationship between pretest scores and experience levels.

Phase One - The Marshall instrument was reviewed and any questions not pertaining to CT 2401 course content were deleted and replaced with pertinent questions. Test data on the remaining questions were examined and those items not having acceptable levels of difficulty and discrimination were revised. The resulting test was then administered to

the group of incoming students taking CT 2401, Fall Quarter 1983, as well as to groups of students who had previously completed the basic course. One of these groups consisted of students who had taken the basic course the previous quarter; the other group consisted of students enrolled in a senior level tailoring course. The majority of them had taken the basic course at least one year prior to this testing. The test was given to the latter two groups so that a larger number of results from students who had taken the beginning course could be analyzed. This same initial test was given as a posttest to students enrolled in CT 2401 at the end of Fall Quarter 1983.

Based on the results of the above four test administrations, the item analyses were examined in order to select the questions that best discriminated between the low, the average, and the well qualified student. Questions with poor discrimination or inappropriate difficulty were rewritten. The test was also submitted to clothing construction faculty members who were asked to evaluate individual items for appropriateness and clarity. It was important that the items test knowledge and not ability to read confusing questions.

Phase Two - Consultants from the test development division of the Learning Resource Center (Frary, 1983) recommended that the test consist of approximately 70 questions so that fatigue would not bias the results. Since

the purpose of the test was to identify the highly qualified student, it was also recommended that a few questions covering advanced construction techniques be used. The number of items decided on was 65 covering course content and five covering advanced techniques.

In order to determine the best selection of items, CT 2401 objectives were analyzed and an alloted percentage of questions was assigned to each objective based on the amount of course time devoted to that topic (Table 1). The course content was examined and a list made of construction areas and individual competencies that the test should cover. These were then categorized according to the objective they fulfilled.

Each question was classified according to the major emphasis of its content. Many questions were not mutually exclusive as to content area because they drew on knowledge of one area and then application of this knowledge to another. The percentages of test items for each construction area was checked to see that they were appropriate for the course objectives. The second revision of the test, which consisted of 70 items, was administered at the beginning of Winter Quarter 1984 to 39 students enrolled in the basic construction course.

In addition to reviewing the item analysis, a Table of Specifications was developed that indicated the percent of test items necessary for each objective and the subject

Table 1. Objectives and the percentage of time devoted to each one.

Objectives	Percent
Demonstrate a knowledge of the relationships between fiber type, fabric construction, and end use of the garment.	10
Demonstrate an understanding of pattern and fabric preparation through appropriate application.	3
Demonstrate a knowledge of appropriate layout concepts and proper techniques for cutting and marking garment setions.	10
Demonstrate knowledge of basic concepts of sewing machine usage.	5
Understand the garment assembly process and demonstrate an understanding of and excellence in construction skills.	65
Understand beginning concepts of fit and demonstrate ability to achieve elementary levels of fit.	7
Total	100.0

matter that should be covered. The total number or questions to be used was proportioned to each objective (Appendix B). It was found that the number of questions per subject matter area was inappropriate. Some areas of content were being over tested while other areas were being neglected. The Table of Specifications was ordered so that the subject matter areas were each ranked in a heirarchy according to importance and complexity within the objective. Numbers of questions were then assigned. If the amount of questions was appropriate and the levels of difficulty and discrimination acceptable on the trial test then no further revision was made. However, new questions were added for areas that showed poor item analysis figures or if the subject area was inadequately covered. Since these new items would only have one testing (the Winter Quarter posttest) before the construction of the actual exemption test, at least one more question than necessary was included for each subject matter area. This allowed a choice of those items with the best item analysis figures. The original winter quarter test was given again as a posttest along with the additional new items.

Phase Three - The pool of items from the phase two postest was used to construct the actual exemption test. The content areas for the final form of the instrument were selected according to the Table of Speifications.

Sample

The sample for the trial tests consisted of all students enrolled in CT 2401: Basic Apparel Construction, during Fall Quarter 1983 and Winter Quarter 1984. All 22 students enrolled in CT 2401 during Spring Quarter 1984 comprised the sample for the actual exemption test.

Spring Quarter 1984 advanced apparel construction students made up the sample used to check the predictive validity of the test. Five of these 26 students had taken the basic course in the fall of 1983. The remaining 21 took the course during the 1984 winter session.

Administration

The trial tests, which encompassed phase one and phase two, were administered as both pretests at the beginning of the basic course and again as posttests at the end of the basic course. The experience questionnaire accompanied the pretest at the beginning of each quarter.

Phase three was the actual exemption test which was administered on the first day of class during Spring Quarter 1984. All 22 students enrolled in the basic class took the test and filled out the experience questionnaire. During the first part of the quarter, the exemption test was also administered to 26 students in the advanced construction course as a check of the predictive validity of the test.

Analysis of Data

The trial tests and exemption test were developed in a form that could be scored by an optical scanner. A numerical rating scale was used for the experience questionnaire. Concurrent validity was checked by correlating the experience index with the pretest score. Dependent t-tests were conducted on pretest versus posttest scores to check content validity. The predictive validity was checked by correlating scores on the test with final grades in the course. The mean and standard deviation of each test was evaluated.

The item analysis was examined for each individual question to determine its suitability in terms of difficulty and discrimination. The Knuder-Richardson 20 computation for internal consistency was used as a reliability test.

CHAPTER V

FINDINGS AND CONCLUSIONS

The clothing construction exemption test was developed in three phases (Appendix A). The first phase involved the pretest and posttest administered Fall Quarter 1983. The main purpose of this phase was the accumulation of data on individual questions. Phase two included the pretest and posttest given Winter Quarter 1984. These test administrations were used to acquire data on revised questions and to categorize items based on the Table of Specifications (Appendix B). Phase three involved the design of the actual exemption test and the selection of the best subject related items as determined by the Table of Specifications. Findings and discussion are presented on each phase. Conclusions are stated after these sections.

Sample

Basic apparel construction is generally scheduled during the sophomore or junior year for students that are required to take the clothing construction sequence. There are usually four sections of the course with approximately 20 students per section. One section is taught during the fall, two during winter, and one spring quarter. The majority of students taking apparel construction are in the

Clothing and Textile Department (CT) majoring in Fashion Merchandising or Apparel Design for whom it is required. The course is a popular elective with students from other colleges who simply want to learn the principles of apparel construction. Table 2 shows the distribution of this sample.

Phase One

The primary purpose of phase one of the development was to collect data on difficulty and discrimination of individual test items. The item analysis from previous testings of the Marshall (1967) instrument were examined and items not showing desirable levels of difficulty and discrimination were revised. Questions not pertaining to the content of CT 2401: Basic Apparel Construction were deleted. The resulting 102 item test was given to the basic class at the beginning of Fall Quarter 1983.

The resulting mean was 60.05 (59 percent), a little higher than desired. The standard deviation was 12.412 which showed the scores were spread out from the mean (Table 3). The range was 41 to 79 (40 to 71 percent) correct. The KR-20 for this testing was .888 which was in the acceptable range.

This same test was given to students who had previously taken the basic course. It was expected that the mean would be higher and the standard deviation less. The mean was

Table 2. Distribution of sample for 1983-1984 academic year.

	Fall	Winter	Spring	Total	Percentage
Freshmen	1	5	5	11	13.8
Sophomores	13	22	11	46	57.5
Juniors	2	10	4	16	20.0
Seniors	4	1	1	6	7.5
Graduate Students	0	0	1	1	1.2
Total	20	38	22	80	100.0
CT Majors	19	34	16	69	86.2
Other Majors	1	4	6	11	13.8

Table 3. Comparisons of Phase One, Phase Two, and Phase Three.

Phase	Mean	Standard Deviation	KR-20	Range	Significance Level	Critical Value	Test Statistic	Difficulty Indexes Over .70	Discrimination Indexes Under .30
Phase One (102 Items)					.05	1.771	25.97		
Pretest	60.05 (59%)	12.412	.888	41-79 (40-71%)				35 (34%)	55 (54%)
Posttest	70.67 (69%)	6.037	.688	56-80 (55-78%)					
Phase Two (70 Items)					.05	1.686	19.312		
Pretest	33.05 (47%)	7.507	.758	19-51 (27-73%)				10 (14%)	39 (56%)
Postest	52.05 (74%)	7.302	.821	33-69 (47-99%)					
Phase Three (71 Items)									
Pretest	30.82 (43%)	8.167	.817	17-48 (24-68%)				8 (11%)	39 (55%)

74.415 (73 percent) and the standard deviation, 10.475. The test was not as difficult for this group and the scores were not as spread out. The KR-20 was .866, indicating that the test was considered reliable.

The item analysis for the beginning group showed that 35 (34 percent) of the items had difficulty levels of over .70 and were, therefore, too easy (Table 3). Fifty five (54 percent) had discrimination indexes of less than .30 and could not be considered discriminating. Of those 55, 11 (11 percent) had negative correlations showing that the better students were the ones who missed those items. At this point the test needed considerable revision, and the item analysis indicated the specific questions that needed to be changed.

The test was given without revision as a posttest at the end of the quarter so that a comparison could be made with the pretest. The results are summarized in Table 3.

Because more students would be able to answer the questions correctly, it was expected that the mean of the posttest would be higher (69 percent). Also since all students had been exposed to course content during the quarter, they were expected to possess some knowledge of the subject. Thus, the standard deviation should be lower as it is a measure of variability and on the posttest there would be less variability than on the pretest. The range of scores for the posttest was 56 to 80 (55 to 78 percent). A

dependent t-test was computed on the pretest scores versus posttest scores to see if the posttest scores were significantly higher. The significance level was set at .05 (n=20) for a critical value of 1.771. The test statistic was 25.97 showing that the posttest scores were signficantly higher, indicating that the knowledge students gained during the quarter was being tested (Table 3).

Phase Two

Questions with unacceptable levels of discrimination and difficulty on the first testing were examined and revised before Winter Quarter 1984. The test was reduced to 70 items in order to make it short enough to have ample time for answering all items in one class period and yet still have enough items to keep it reliable. Each objective was assigned a specified number of questions and then the questions were classified according to the objectives (Appendix B). Test items with the best item analyses figures were selected for the Winter Quarter trial test.

The test form was also revised. The fall test contained various types of objective questions such as true-false, matching, multiple choice, and multiple choice with reference to an illustration. This required several sets of directions. The questions were reworded so that all could be multiple choice, eliminating the need for more than one

set of directions. This helps eliminates possible confusion and increases test accuracy (Ahmann and Glock, 1975).

The test was administered as a pretest to the basic class at the first class meeting Winter Quarter 1984. The mean of that test was 33.05 (47 percent), the standard deviation was 7.507 and the KR-20 was .758 (Table 3). The difficulty level of the test was improved from phase one and the variability was still good. The numbers were lower because the total number of questions on the test was lower. The reliability, however, was not quite as high as desired. Scores ranged from 19 to 51 (27 to 73 percent). Of the 70 items on the test, ten (14 percent) had difficulty levels of over .70 (Table 3). This was an improvement over the 34 percent of the previous test but still not as low as desired. Thirty nine (56 percent) had discrimination indexes of less than .30, approximately the same percentage as for the previous testing. Of those 39, eight (11 percent), the same percentage as on the previous testing, had negative correlations.

At this point the questions had been classified under objectives, but not according to content. Now they were further broken down into content area within the objectives. This listing by subject matter showed some areas with no questions. The desired number of questions for each subject matter area was determined (Appendix B). Areas without questions and those with questions having less than

desirable item analysis figures were examined and questions written or revised. Sixty new questions were included on the posttest of phase two. However, the original pretest questions remained intact so that as a posttest those items could be scored separately and compared with the pretest scores.

The mean increased to 52.05 (74 percent), however the variability remained essentially the same (Table 3). The range of scores for the posttest was 33 to 69 (47 to 99 percent). A dependent t-test showed that the posttest scores were significantly higher than the pretest scores. The level of significance was .05 (n=38) with a critical value of 1.686. The test statistic for phase two was 19.312. This significant difference indicated that the students knowledge of the subject matter covered by the test had increased between the pretest and posttest.

Phase Three

The first two phases of the test were conducted in order to select the best questions for the exemption test. Item analysis figures on the additional 60 questions given with the posttest in phase two were analyzed. The acceptable difficulty level for this group was set at .80. It was higher because the posttest score reflected knowledge after the course rather than before. The Table of Specifications (Appendix B) was the guide used to select the

number of questions per content area. The item analysis was the basis of choosing the questions from the available pool for each content area.

The resulting test contained 71 items. The mean was 30.82 (43 percent), lower than the desired level of approximately 50 percent (Table 3). The standard deviation was 8.167 which reflected a wide spread of test scores. The scores ranged from 17 to 48 (24 to 68 percent). Both the mean and variability indicated that the test was more difficult than previous tests. The reliability as measured by the KR-20 was .802. This was not as high as some of the previous tests but still above the minimum acceptable level for an exemption test.

The optimum difficulty range for an exemption test should be approximately .50 (Adkins, 1974). The mean difficulty of all questions for this test was .434. This indicated that the test was too difficult. Item analysis showed that of the 71 items on the test eight had difficulty levels of over .70, indicating that they may be too easy for a placement test. Of those eight questions, four were above the .80 level showing that they were fairly easy. These should also be examined for possible "give away" wording. There were ten questions on this test that fell below .20 These questions may either be too difficult or poorly stated. Examination of the discrimination index would indicate whether or not it was the high scoring students who

were the ones answering correctly. If not, then the items should be considered for revision.

The discrimination index for the 71 questions ranged from -.36 to +.73. Over .30 was the desired level and under .20 indicated the discriminating power was questionable (Ahmann and Glock, 1975). The well constructed test should have more than 50 percent of the items exceeding .40, less than 40 percent with values between .40 and .20, and less that ten percent below .20. None should have negative values (Ahman and Glock, 1975). A further breakdown of the discrimination indexes for this test administration is presented in Table 4. There were 32 items (45 percent) that met the acceptable level of over .20. Thirty nine items (35 percent) did not discriminate well. Of those items, eight (11 percent) had negative values. Of the 33 items below .20, 27 had indexes higher than .20 on at least one previous testing. No items with negative values on previous tests had been selected. The discrepancies in values were most likely due to the small sample size. With a sample of only 22, one or two lucky guesses or careless interpretations could alter the item analysis a great amount (Frary, 1984). Samples of items from each objective along with their item analysis figures are listed in Appendix D.

The test was administered to students enrolled in advanced apparel construction Spring Quarter 1984. This testing allowed examination of item analysis for students

Table 4. Distributrion of difficulty and discrimination levels for phase three.

Item analysis	Number of Questions
Difficulty Level	
.00 - .19	10
.20 - .39	21
.40 - .59	24
.60 - .79	12
.80 -1.00	4
Discrimination Index	
0.40 and up	20
0.30 - 0.39	12
0.20 - 0.29	6
0.00 - 0.19	25
Below 0.00	8

who had completed the basic course. It could not be used for analyses involving correlations with the pretest because the responses were from different groups. However, it did provide some information as to the difficulty levels and discrimination indexes of the individual questions. The mean of this test was 50.41 (71 percent). The standard deviation was 7.559 and the reliability estimate (KR-20) was .827 (Table 3). These figures were all in the acceptable range. The mean for the posttest should fall between 70 and 80 percent (Frary). This mean was at the low end of the range which could indicate that some of the questions were too difficult. An examination of the item analysis showed five questions (seven percent) to have a difficulty level of less than .25 which indicated that over 75 percent of the students missed those items. Those five items were the ones that would be considered for revision. Other possible reasons for the divergent scores were: any given group of students may have performed poorly on an item because their instructor did not emphasize the principle being tested, individual differences could result from students being absent the day the concept was explained, and small samples sometimes give misleading figures, and this was not a pretest.

Items with negative discrimination indexes should also be reevaluated because it would indicate that something about the item was misleading. There were seven items (ten

percent) on the test having negative indexes for this administration.

In addition to the item analysis, the validity of the exemption test was checked in three ways: concurrent validity, content validity, and predictive validity. Concurrent validity measures the ability of the instrument to estimate present status with respect to the characteristic for which it was designed (Ahmann and Glock, 1975). In this research it refers to the ability of the exemption test to measure clothing construction skills. The method used to check concurrent validity was the experience questionnaire (Appendix C). The individual rating on the experience questionnaire was correlated with the score on the pretest using the Pearson r. The correlations were:

Fall	.90056
Winter	.90388
Spring	.79637

All were considered to have high to very high positive correlations (Hinkle, Wiersma, and Jurs, 1979), indicating that the test did measure levels of clothing construction skills.

Whether or not the test measured the specific areas of construction that it is designed to measure is a function of content validity. The exemption test was developed according to the Table of Specifictions (Appendix B) to cover all course content. In order to determine if the questions were

measuring the knowledge presented in the course, dependent t-tests were conducted on pretest versus postest scores for each phase (Table 3). The magnitude of the test statistics indicated that the students had gained knowledge in the specific areas of construction that the test measured. The critical values differed in each phase because the number of students was different. It is expected that a dependent t-test on the exemption test scores and posttest scores for phase three will be significant also. Although some of the individual questions were changed for the exemption test, the changes were minor.

The other type of validity of concern for this test was predictive validity. This was important, not for the purpose of predicting success in the class, but to show that those students who scored high on the posttest possessed the knowledge necessary to exempt the course. The posttest score and the grade received in the class were correlated, using the Pearson r computation. This was calculated for all 55 students who had posttest scores from phase one and phase two. The correlation was 0.6317 which is considered moderately positive (Hinkle et al., 1979). Although a higher correlation might be expected, there were factors other than knowledge that affected the course grade. Students were subjectively evaluated on the excellence of their skills as demonstrated by construction projects. Students may possess the knowledge of what is required for a

skill and understand the principle of it but yet not have developed the skill to the degree required for a high grade. The final grade was also based on projects being turned in on time and on scores from tests during the earlier part of the course while the knowledge and understanding were still being developed. Therefore, not all students who gained the knowledge presented in the course received high grades. A more accurate check of predictive validity might be a correlation of the posttest scores with the final exam scores rather than with the final grades.

Methodology

The methodology used to develop this test is also of interest. Although it has been described during the developmental phases of the exemption test, it warrants further discussion that focuses on the methodology rather that the test. First, the course behavioral objectives were examined and assigned a percentage rating corresponding to the amount of class time devoted to each objective. Since the listing of behavioral objectives did not exist, the development of such a list was valuable. The listing enabled evaluation of the course and teaching methods. It was difficult to judge whether or not the course was being successfully taught when no guidelines as to what needed to be accomplished existed. After the objectives were assigned a percentage of class time, individual learning concepts

were analyzed and listed under the objectives to which they pertained.

Once this categorization was accomplished, each objective was examined independently. The learning concepts were ranked according to importance and complexity within the objective. Refer to Appendix B for an example. This ranking gave concrete guidelines for structuring instructional materials as well as guidelines to follow when developing tests.

To develop the test, the total number of questions desired was first established. The percentage assigned each objective determined the number of questions on the test pertaining to the concepts within that objective. The heirarchy of concepts was then used to decide how many of those questions should pertain to each concept. This process, if used with college courses, would not only assure comprehensive evaluation, but also provide continuity of course content regardless of the number of sections and/or instructors.

Implications

This research was conducted because of the need to group students based on ability and the lack of any method for doing so at this institution. The questions on the exemption test were selected based on performance as judged by item analysis. However, the item analysis on the final

test indicated some weak questions. In order for the faculty at this univeristy to utilize this instrument as an effective evaluation tool, it is suggested that:

1. Questions receiving low or negative discrimination scores during phase three be evaluated by faculty members for clarity and content.
2. Questions receiving low or negative discrimination scores from the advanced students be considered for minor revision.
3. Item analysis of questions be recorded and evaluated for two or three more administrations before the test is instituted as an exemption test.
4. The test be given as a posttest for the above two or three quarters in order to help establish a minimum level for exemption. It was recommended by Frary (1983) that on the posttest 70 to 80 percent of the students should score above the exemption level.
5. The use of the experience questionnaire be discontinued since its purpose as a validity check has been served.
6. The Table of Specifications be revised as necessary and the exemption test be checked periodically for content validity.
7. A file of item analysis figures be kept for each question and evaluated periodically.

8. Questions that continue to show poor discrimination and/or difficulty levels be replaced.
9. Posttest scores be correlated with final exam scores as a check on the predictive validity of the test.
10. Students who exempt the basic course be evaluated as to success in the advanced course.
11. That a bank of questions with item analysis figures be developed by having all objective questions on regular classroom tests scored by an optical scanner and filed according to content area.
12. That once a bank of acceptable questions is established, the exemption test be computer generated with the items for each subject matter area being randomly selected from the pool of questions in that file.
13. The test be revised to encompass the objectives and content of basic construction courses at several other institutions in order to evaluate its adaptability.

Conclusions

The underlying objective of this research was to develop a test that would measure a student's knowledge in the subject matter areas contained in CT 2401: Basic Apparel Construction. The test was to be used as a pretest at the beginning of the quarter for the purpose of exempting

qualified students who came into the course possessing a major portion of the knowledge that would be presented.

The mean, the difficulty levels, and the discrimination indexes of the final phase three exemption test were all less desirable than those on the previous phase two test form. Although some of the discrepancies may have been a result of the changed questions, it was also possible that the small sample did not contain enough students who had sufficient experience and knowledge to provide a full range of skills so that the test could discriminate among them. Before deciding to change any of the questions, the item analyses from previous testings were examined. Since all questions had performed adequately before, the test was then given to the advanced class, those who had completed the course, and it was this item analysis that was considered a more accurate indicator of those items that needed reevaluation. Major changes to any item could not be based on any one set of item analysis figures because of the small sample sizes.

The wide range of scores on the final test (24 to 68 percent) was desirable. The variability indicated by this range was important because errors of measurement become less significant as the variability increases (Ebel, 1972).

The reliability estimate was generally within the acceptable level thoughout the development of the test. Although it may change slightly each time the test is given,

past performance indicated that the test can be considered reliable.

The multiple validity checks produced evidence that the test met all preestablished requirements. The correlations between the experience indexes and individual scores indicated construct validity. Content validity was demonstrated both by following the Table of Specifications and by the Test statistics resulting from dependent t-tests on pretest versus posttest scores. The predictive validity was shown with the correlation between posttest scores and course grades. This figure was only moderately positive. However, other factors that entered into the determination of course grades would have kept it from being extremely high.

The methodology used to develop this test could be applied to developing other tests. As a result a test would encompass all course learning, yet not "over test" one area while barely touching on another. It would assure that the test was representative of course learnings. The methodology would be appropriate for regular classroom tests and individual level evaluation as well as for the purpose used in this research which was an exemption test.

Considering all aspects of the test, the investigator was satisfied that the objectives of the research were met and pleased with the bonus of working out an excellent

methodology for test making. A few individual test items need reevaluation but the changes required should be minor ones.

CHAPTER VI

SUMMARY

Students enter beginning level clothing construction courses with a variety of skills, knowledge, and background experiences. In order for a course to be challenging and meaningful to all participants, it must be at a level that is not overly repetitious of previous learnings. When students possessing considerable sewing skills are in the same learning situation as novices the needs of one or the other will not be fully met. Competency based education, by emphasizing results, concentrates on an individual's skills and knowledge and, in so doing, recognizes individual differences between students. All students do not have the same needs and so should not have to start a series of learning at the same level.

The purpose of this research was to develop a method of separating novice and experienced students in the clothing construction program at this institution in order to allow the experienced student to exempt the basic course. By being able to do this, the students would enter the program at a level closer to their ability, but also have available time to take an additional course. At a time when there are so many demands on a students time, this would be an added advantage.

Tests of this type have been developed at other institutions (Epps, 1972; LaFrenz, 1979; Marshall, 1967; McDonald, 1964; Semeniuk, 1961). However, most of those available for study were developed some time ago. Construction techniques and terminology have changed along with recent developments in fibers and fabrics. Additionally, to be of value a test must be based on specific course objectives and content (Ebel, 1972).

The objective of this research, therefore, was to develop a written exemption test, based on course objectives, that demonstrated content validity and reliability. The test was developed in three phases. The purpose of the first phase was simply to collect data on individual questions concerning level of difficulty and ability to discriminate. The trial of this instrument was administered as a pretest and then as a posttest. Questions with the best item analysis figures were selected for phase two. During the second phase, course objectives were stated in behavioral terms. They were:

At the conclusion of this course the student should be able to

1. Demonstrate a knowledge of the relationships between fiber type, fabric construction, design selection, and end use of the garment.
2. Demonstrate an understanding of pattern and fabric preparation through appropriate application.

3. Demonstrate a knowledge of appropriate layout concepts and proper techniques for cutting and marking garment sections.
4. Demonstrate knowledge of basic concepts of sewing machine usage.
5. Understand the garment assembly process and demonstrate an understanding of and excellence in construction skills.
6. Understand beginning concepts of fit and demonstrate ability to achieve elementary levels of fit.

A Table of Specifications (Appendix B) was developed by assigning each objective a percentage according to the amount of class time devoted to it. All subject matter areas were listed under the objective they reflected. These content areas were then arranged in a heirarchy according to their importance and complexity. The total number of questions was decided and each objective was apportioned an amount according to the percentages previously assigned. The individual questions from the first testing were then classified as to the subject matter they tested.

Areas with no representation required the addition of new questions while areas that were overly represented needed to have questions deleted. The new questions were included on the phase two posttest in order to have an item analysis for evaluation of these additional questions.

Phase three involved construction of the final exemption test. Questions were selected according to the Table of Specifications and based on item analysis figures. The desired level of difficulty was under .70 for the majority of individual questions with a mean difficulty near .50. The goal for the discrimination index was .30 to .50 with no negative values. The reliability as measured by KR-20 needed to be over .800. Questions selected for the final test met all these criteria. However, the item analysis of the final test did not meet these qualifications. The mean difficulty was .434 indicating that the test may have been too difficult. Only 32 items (45 percent) met the desirable discrimination level, and eight (11 percent) had negative correlations. The sample for this testing was composed of only 22 respondents, therefore, its size may have confounded the figures.

The validity was checked on three levels. Construct validity was checked with the use of an experience index (Appendix C); a questionnaire that rated their own perception of their level of skill. The correlation between pretest scores and experience index was in the high to very high range for all three phases which indicated that the test demonstrated construct validity.

Content validity was a function of the method of test construction (designed from the Table of Specifications), and was measured by the results of depentant t-test on the

pretest versus posttest scores. Test statistics were very high indicating that the test did cover course content.

Predictive validity was checked by correlating posttest scores with final course grades. The correlation was moderately positive, however, since other factors besides knowledge and understanding affect final course grades this was considered adequate.

The results of the above figures indicated that the final exemption test was both reliable and valid, thus, the research objectives were met. However, the difficulty and discrimination of individual items needed further evaluation.

With minor revisions, this test would be adaptable for use by other institutions because of the way it was developed. Although objectives might differ for basic courses at other institutions, much of the content would remain the same. Their objectives could be delegated the percentage of course time as the ones in this research were. Then any applicable content areas from this test would be listed under corresponding objectives. Some questions may need to be deleted and some added, but, because of the classification system used, it would be easy to decide on the individual areas that would need revision.

CHAPTER VII

RECOMMENDATIONS FOR FURTHER RESEARCH

As a result of this research, the author suggests the following recommendations for further study:

1. That the methodology from this test be used for other classroom situations and then evaluated as to the effectiveness of both testing and teaching methods.
2. That a survey of other institutions be conducted to determine how they deal with the problems associated with differing levels of experience in basic clothing construction courses.
3. That a study be conducted to determine the success of exemption tests in other academic subjects.
4. That the merits of alternative methods of teaching clothing construction be examined. Some possibilities would be self-paced courses, individual content modules, and multiple one hour sections.
5. That a longitudinal study of students exempting courses in various areas be conducted and compared with students not exempting courses.
6. That researach be conducted on the use and effectiveness of practical tests.

7. That a study be made of methods of determining exemption levels for various academic subjects.
8. That a survey be conducted to determine content areas that should be included in basic construction courses.
9. That a study be conducted to see if ready-to-wear quality levels are or should be contained in construction classes.

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APPENDICES

APPENDIX A

Developmental Phases of the Exemption Test

Phase One

Revision of Marshall instrument based on course content → Administration of 102 item Pretest and Experience Questionnaire (September 1983) → Administration of 102 item Posttest (December 1983)

Phase Two

Revision based on course objectives → Administration of 70 item Pretest and Experience Questionnaire (January 1984)

↓

Addition of questions based on Table of Specifications → Administration of 160 item Posttest (March 1984)

Phase Three

Revision based on Table of Specifications → Administration of 71 item Exemption Test (March 1984)

APPENDIX B

Table of Specifications

Objective and Subject Mattter Area	Number on Phase two	Number Required	Question Numbers on Final Test
Demonstrate a knowledge of the relationships between fiber type fabric construction, and end use of the garment.		6.5 (10%)	
Fabric grain	1	1	17
Fabric construction	1	1	15
Fiber care	1	1	45
Pattern sutibility to fabric	0	1	60
Napped fabrics	1	1	9
Bias characteristics	1	1	24
Fabric selection	1	1	46
Total	6	7	
Demonstrate an understanding of pattern and fabric preparation through appropriate application.		2 (3%)	
Pattern preparation	1	1	40
Fabric preparation	1	1	35
Total	2	2	
Demonstrate a knowledge of appropriate layout concepts and proper techniques for cutting and marking garment sections.		6.5 (10%)	
Layout	2	2	39, 47
Cutting	2	2	48, 61
Marking	2	2	16, 62
Techniques for plaids	1	1	23
Total	7	7	

APPENDIX B (Continued)

Table of Specifications (Continued)

Objective and Subject Mattter Area	Number on Phase two	Number Required	Question Numbers on Final Test
Demonstrate a knowledge of basic concepts of sewing machine usage.		3.3 (5%)	
Sewing Machine parts and use	1	1	53
Stitch length	1	1	25
Tension	1	1	63
Total	3	3	
Understand the garment assembly process and demonstrate an understanding of and excellence in construction skills		45 (65%)	
Seams	4	2	1, 32
Staystitching	2	2	37, 57
Pressing	3	2	10, 33
Seam finishes	2	2	4, 44
Facings	1	2	34, 41
Clipping and notching	1	2	64, 66
Darts	4	2	31, 36
Zippers	1	2	20, 54
Skirt waists	1	2	6, 14
Hand stitches	1	2	27, 55
Supporting fabrics	2	2	7, 56
Sleeves	2	2	8, 11
Hems	1	2	42, 50
Fasteners	2	2	12, 65
Collars	2	2	18, 51
Order of construction	3	2	68, 70
Understitching	2	2	3, 71
Grading	2	1	28
Mitered corners	1	1	69
Stitch in the ditch	1	1	30
Ease	1	1	21
French seams	1	1	43
Flat-felled seams	1	1	49
Cutting bias	1	1	13
Gatehring	0	1	29
Total	43	42	

APPENDIX B (Continued)

Table of Specifications (Continued)

Objective and Subject Matter Area	Number on Phase two	Question Number Required	Question Numbers on Final Test
Understand beginning concepts of fit and demonstrate ability to achieve elementary levels of fit.		5 (7%)	
Alteration methods	2	2	26, 58
Pattern selection for figure	2	1	22
Bodice alterations	1	1	2
Skirt alterations	0	1	67
Total	5	5	
Advanced techniques	5	5	5, 19, 38 52, 59

APPENDIX C

Experience Questionnaire

Name_____

Classification (Year) Fr____ Soph____ Jr____ Sr____

Is this course Required____ Elective____

Have you had any previous sewing experience (formal or informal)? Yes____ No____ If so, what?

(If you answered no to the above question, you do not need to answer the remaining items. Thank you for your cooperation.)

Did you have home economics in
High School Yes____ No____ Junior High Yes____ No___

Have you had 4-H clothing experience? Yes____ No____
If so, how many years?

Have you had sewing instruction (lessons) other than in school or 4-H? Yes____ No____
If yes, please list specifics.

Have you ever received any sewing awards? Yes____ No____
If yes, please list.

Do you sew (check one)
A great deal____ Very little____
Some____ None____

Check the garments you have made
Skirt____ Shorts____ Suit____
Blouse____ Slacks____ Coat____
Other (list)____

In column A below, check the practices you can do satisfactorily without advice or assistance from others. In column B, check the practices which you can do but would require further help. In column C, check the practices which you have never done before.

A	B	C	
_____	_____	_____	1. Select materials suitable for the pattern chosen.
_____	_____	_____	2. Select patterns suitable for the figure type.
_____	_____	_____	3. Make pattern alterations when body measurements differ from those of the pattern.
_____	_____	_____	4. Place pattern pieces correctly on material (locating grain lines.)
_____	_____	_____	5. Follow directions on the guide sheet.
_____	_____	_____	6. Select appropriate method(s) of pattern marking, taking into consideration the color and type of material being used.
_____	_____	_____	7. Determine when staystitching should be done.
_____	_____	_____	8. Underline a garment.
_____	_____	_____	9. Properly locate and make machine buttonholes.
_____	_____	_____	10. Use an acceptable method of applying a zipper to a placket.
_____	_____	_____	11. Set in a sleeve an ease in fullness smoothly.
_____	_____	_____	12. Apply various types of collars to a garment.
_____	_____	_____	13. Line a garmet.
_____	_____	_____	14. Match plaids and stripes.

APPENDIX C (Continued)

A	B	C	
_____	_____	_____	15. Select and use appropriate seam finishes.
_____	_____	_____	16. Join bodice and skirt at the waistline.
_____	_____	_____	17. Make a self fabric belt.
_____	_____	_____	18. Put in an inconspicuous hem.
_____	_____	_____	19. Make a French seam.
_____	_____	_____	20. Make a flat felled seam.
_____	_____	_____	21. Cut and join strips of true bias.
_____	_____	_____	22. Miter a corner.
_____	_____	_____	23. Understitch a facing.

APPENDIX D

Sample Test Questions

Objective - Fiber type, Fabric Construction, Design, and Use Relationships

17. Threads running parallel to the selvage are referred to as
    1. crosswise grain
    2. lengthwise grain
    3. bias grain
    4. warp yarns
    5. both 2 and 4 are correct

Difficulty - .59
Discrimination - .48

Objective - Pattern and Fabric Preparation

35. To straighten the end of a piece of woven fabric which has been cut from the bolt, one should first
    1. pull a lengthwise thread and cut on the line it makes
    2. pull a crosswise thread and cut on the line it makes
    3. leave the fabric as it came from the bolt and begin placing the pattern pieces
    4. pull the fabric on the diagonal to straighten the ends

Difficulty - .23
Discrimination - .57

Objective - Layout and Cutting

39. The pieces of a pattern are on the straight of the fabric when
    1. grainline markings are on the true bias
    2. lengthwise grain markings are equidistant from selvage(s)
    3. crosswise grain markings are parallel to the selvage(s)
    4. none of the above

Difficulty - .45
Discrimination - .60

APPENDIX D (Continued)

Objective - Machine Use

25. The stitch length control lever (or dial) on the sewing machine
    1. controls the width of the zig-zag
    2. controls the distance the feed dog moves the fabric
    3. regulates the speed of the machine
    4. none of the above

Difficulty - .64
Discrimination - .50

Objective - Construction Techniques

8. When positioning a sleeve into an armhole (or armscye), have
    1. the bodice turned wrong side out and the sleeve right side out
    2. both sleeve and bodice turned wrong side out
    3. sleeve turned wrong side out, bodice right side out
    4. both sleeve and bodice turned right side out

Difficulty - .36
Discrimination - .73

Objective - Fitting Principles

67. When adding width to the hips of a straight skirt
    1. add the width between the hipline and waistline
    2. add width only in the hip area
    3. add an equal amount from the hipline to the floor

Difficulty - .50
Discrimination - .26

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