DEVELOPMENT AND EVALUATION OF A WAIVER EXAMINATION FOR
THE INTRODUCTORY FOODS COURSE AT UTAH STATE UNIVERSITY

by

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of the requirements for the degree

of

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in

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Sincere appreciation is expressed to my committee chairman, Dr. Ethelwyn Wilcox for her critical review and assistance in writing the thesis, Mrs. Janel Dayton, for her helpful suggestions, and Dr. Donald V. Sisson, Department of Applied Statistics, for his suggestions and help in the statistical analysis.

I would also like to thank Dean Phyllis R. Snow, College of Family Life, Mrs. Grace Smith, and Mrs. Georgia Lauritzen for their suggestions and help in developing the table of specifications used in writing the initial examination.

I am especially grateful for the funds provided by a University Research Fellowship which has made this study possible.

Finally, to my husband, Donald, for his faith and support in fulfilling this assignment, I extend a wife's gratitude.
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ABSTRACT

Development and Evaluation of a Waiver Examination for
the Introductory Foods Course at Utah State University

by

Virginia C. Bragg, Master of Science

Utah State University, 1968

Major Professor: Dr. Ethelwyn B. Wilcox
Department: Food and Nutrition

A written objective-type waiver examination for the introductory
foods course at Utah State University has been developed and evaluated.

Results of the study showed that the examination improved with
revision. In addition, it was found that there was a statistically significant
relationship between the score students achieved on the waiver examination
and the total numerical score representing the final grade in the basic
foods course.

There was apparently no significant relationship between the number
of years experience students had in food preparation, the type of experience
in food preparation, and their performance on the waiver examination.
Apparently depth of knowledge of basic food preparation principles was
a more important factor than just years or breadth of experience (skill)
in contributing to the waiver examination score.

The waiver examination has been adopted for use by the Department
of Food and Nutrition at Utah State University.
Recommendations are made regarding use of the examination and the possible need for re-evaluation of the curriculum for introductory foods work.
INTRODUCTION

It has been observed for some time that many students who are required to take the introductory foods course at Utah State University have felt that they had a satisfactory background in food preparation and should be allowed to enter meal management without taking the basic food preparation course. This observation had been brought to the attention of faculty members of the Department of Food and Nutrition through the complaint of students that there was repetition of work. These students felt that they had learned the principles of food preparation in high school home economics courses or in the 4-H program training.

The increasing development of high school and university honors programs has helped intensify the observation that many students already have the basic training in many supportive disciplines which should be applicable in knowledge of food preparation principles. It was felt that those honor students or students with experience in foods who were adequately prepared could more profitably spend their time in more advanced food courses by waiving the introductory foods course. This would present a challenge to those students who often may feel that time was being spent in repeating something they already knew. It would also give these students the opportunity to further develop in depth or in breadth of course work which would more adequately meet their needs and abilities in professional and community life.
The rising cost of education should be an important factor considered by the educator. It is the responsibility of educational institutions and educators to provide the best possible education in return for the student expenditure of time and money. It would certainly seem advisable to prevent unnecessary repetition of course material which necessitates a waste of the students' time and money.

The use of the waiver examination is certainly not a new idea, as other universities and other departments at Utah State University use this means of progressing the adequately prepared students on to more challenging work.

Use of waiver examinations in the field of food and nutrition at the university level has not been described extensively in the literature, as few references outlining such procedures were found in the scientific literature.

Objective

The purpose of this study was to develop and evaluate a waiver examination for the introductory foods course (Food and Nutrition 23) to be used by the Department of Food and Nutrition at Utah State University.

Statement of hypotheses

The null hypotheses to be tested by the study were:

1) There is no relationship between the number of years experience in food preparation, an understanding of principles involved in food
1) There is no relationship between experience in 4-H foods programs, an understanding of principles involved in food preparation, and the score on the waiver examination. 2) There is no relationship between experience in high school foods courses, an understanding of principles involved in food preparation, and the score on the waiver examination. 3) There is no relationship between experience in high school foods courses, an understanding of principles involved in food preparation, and the score on the waiver examination. 4) There is no relationship between the waiver examination score and the total numerical course score representing the final grade in the introductory foods course.
REVIEW OF LITERATURE

The importance of evaluation in the educational process has been noted by several authors, including (Arny, 1953; Remmers and Gage, 1955; and Ricks, 1962). Part of evaluation includes measurement and the construction of valid measurement devices. Remmers and Gage (1955) indicate that measurement devices, as a part of evaluation, may be used for a variety of purposes, i.e., guiding students, selecting students, motivation of learning, guiding learning, and appraisal of teachers, teaching methods, books, and curricular content.

There has been an increasing use of measurement devices on the university level, particularly those devices used for waiver or placement purposes. The Committee of Measurement and Evaluation of the American Council on Education (1959) stressed the importance of the recognition of individual student differences in educational background and the adjustment of the educational curriculum to most effectively meet the individual needs of each student. Placement examinations are a well accepted means of recognizing differences in background and academic preparation. The use of the waiver examination is desirable in those instances where the student has already mastered the skills and knowledge included in a fundamental course.

One of the first studies in the use of placement or waiver examinations in the field of food and nutrition was that of Kolshorn (1927) at the University
of Minnesota. An objective-type written examination was developed and administered to freshmen. The scores were used to determine which students would be allowed to enroll in a three hour foods course instead of the regular five hour course. After use of the test score as basis for placement for a period of two years, mental rating, honor point ratio, and previous experience in foods were added to the test score as criteria by which a more satisfactory grouping could be made.

A follow-up of this same study was reported by Brown (1930). Revisions of the original objective examination had apparently been made, but the examination score together with mental rating, honor point ratio, and experience in foods were still used as criteria for grouping of students. This study was done to determine how significant the selected criteria were in the sectioning process. The test was found to have a reliability of 0.75. Generally, the test score was more successful in predicting student success in the food preparation course than in measuring the student's ability in foods. The experience factor was not well correlated with the other factors.

Bloye (1928) reported the use of a 100 item objective test for sectioning all freshmen girls registered in the school of Home Economics at Purdue University. Material covered in the examination included the areas of food composition, food selection, food preparation, and meal service. The students were divided into three groups on the basis of test scores. Only one trial of the examination had been completed. It was found at the time that students with high scores on the test also
had high intelligence ratings and high grades in the foods course. Conversely, students with low test scores tended to have lower intelligence ratings and lower grades in the course. It was indicated by the author that further revision and development of the method would continue.

Bloye and Long (1941) reported an experiment at Purdue University in teaching food preparation to college freshmen involving laboratory sectioning on basis of "student determined need." Two types of laboratory teaching were used; the demonstration method and the usual procedure of having students prepare products in the laboratory. A written examination and laboratory examination were used to determine which method of teaching had been most beneficial to the student. The method of teaching did not seem to produce a measurable difference in the average scores on the examination. Validity of the instruments used was not reported.

Wangsgard (1958) reported the development of a food laboratory examination for use at Cornell University. The author indicated the need for determining the breadth and depth of experience of students in food preparation to ensure proper structuring of the foods course to meet student needs. She described the test instrument in detail and gave a complete discussion of typical student responses. She concluded that the instrument needed further development and recommended that the most effective measurement of student ability in foods was accomplished by the use of a combination of a written and a practical examination. The author further indicated that the completed test could be used for evaluation of course content, placement of students, waiver of the foods course,
evaluation of student achievement, and as a measurement of student progress in the foods course.

Steelman and Barbour (1965) have developed and evaluated a pre-test for a beginning college foods course with the intent of using it to evaluate the competence of all beginning students in food and nutrition at Oklahoma State University. They indicated that little has been done to accelerate qualified students in home economics and feel that there was a need for systematic evaluation of beginning students in food and nutrition so that the student may be placed in the course work which will most nearly meet his needs. Their test consisted of a written theory portion and a recognition-type practical portion. They concluded that the test needed further refining, but felt it was a much needed device.

Youmans (1959) and Lyman (1963) indicated that the most important characteristic of a measurement device is its validity. A valid device should be 1) compatible with the goals set, 2) objective enough to minimize individual opinion, 3) specific to the situation, and 4) discriminating.

Much has been written in the literature concerning the construction of a measurement device. Bean (1953), Furst (1958), Lawshe (1948), Lindquist (1951), Michells and Karnes (1950), Remmers and Gage (1955), and Thorndike and Hagen (1955), seemed to parallel one another in their suggestions and discussion.

The following steps for building a measurement device--test--given by Micheels and Karnes (1950, p. 126-129) are a good example of the steps listed by other authors.
1. List the major objectives for which an appraisal is desired. 
2. Examine the course content for additional objectives. 
3. Analyze and define each objective in terms of expected student outcomes. 
4. Establish a table of specifications. 
5. Construct one or more test items for each objective listed. 
6. Assemble the items for the test. 
7. Write clear and concise directions for each type of question. 
8. Study every aspect of the assembled test. 
9. Construct the key. 
10. Have other instructors criticize and, if possible, actually take the test. 
11. Make any necessary revisions. 
12. After the test has been administered to one or two groups of students, analyze and improve it.

Choice of the type of test items used depends upon the needs and purposes of the test. However, most authors, (including American Council on Education, 1959; Arny, 1953; Bean, 1953; Furst, 1958; Lindquist, 1951; Micheels and Karnes, 1950; Remmers and Gage, 1955; and Thorndike and Hagen, 1955) have tended to prefer the objective type question for use in placement and waiver tests because of the case in grading, unbiased nature of the grading, and the fact that these test items lend themselves readily to statistical analysis.

Many authors discussed the types of test items and illustrated methods for construction of each of the various types of objective test items. Since it was not the purpose of this study to make a thorough review of the literature on how to construct a valid test, the reader is referred to the references cited for further explanation of the procedures involved.
PROCEDURE

Prior to the construction of the initial examination, the objectives of the waiver examination were discussed with the food and nutrition faculty and a table of specifications was developed from their suggestions.

The principle objective of the examination was to determine by examination if the student had sufficient skills and understanding of the principles of food preparation to perform efficiently in either meal management (Food and Nutrition 25) or experimental foods (Foods and Nutrition 107) without taking the introductory foods course (Food and Nutrition 23). The table of specifications developed is presented in Table 1.

Administration of initial examination

An examination of 100 multiple choice or modified multiple choice items was written. Objective type items were used because of ease in grading and statistical analysis.

The examination was administered to 100 university students of mixed sex and background. Included in this group were the 25 students enrolled in the introductory foods course (Food and Nutrition 23) spring quarter of 1965. The remaining 75 students were those enrolled in introductory psychology and child development courses. The examination was given to the Food and Nutrition 23 students the first day of class. Students were asked to indicate the number of years experience in foods at home, at school, and in 4-H programs.
Table 1. Table of specifications devised for waiver examination

<table>
<thead>
<tr>
<th>General Areas of Knowledge and Weighing</th>
<th>Principle or Product Involved</th>
<th>Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Terminology</td>
<td>Description of procedures and method—being able to follow recipe</td>
<td>Fold, marinate, bake, baste, broil, whip, etc.</td>
</tr>
<tr>
<td>10 per cent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II Proportions of Ingredients in recipes</td>
<td>Ability to recognize type of product produced from recipe</td>
<td>Pie, cake, biscuits, muffins, etc.</td>
</tr>
<tr>
<td>20 per cent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III Knowledge of basic procedures for preparation</td>
<td>Vegetables, Fruits, Meat, Eggs, Milk and Cheese, Cereals, Baked goods, biscuits, pastry, muffins, cake, Gelatins</td>
<td>Vegetable cookery and care, Combining hot paste with egg, Starch Cookery, Muffin method, Conventional cake method, Pastry method, Types of flour, Pastes and rice, Baking powder action, Leavening agents, Meat Cookery</td>
</tr>
<tr>
<td>65 per cent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV Temperatures</td>
<td>Relative temp. for cooking foods</td>
<td>Meat, Cheese, Eggs</td>
</tr>
<tr>
<td>5 per cent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The examinations were graded using a key and were then ranked in descending order on the basis of raw score. The upper and lower 27 per cent of the papers were selected for use in the statistical analysis for item discrimination.

**Evaluation of initial examination**

The number of correct and incorrect responses in each of the two groups, high and low, was tabulated for each test item. The per cent of correct responses for each of the two groups was then calculated. The item discrimination was determined using the Lawshe nomograph (Lawshe, 1942, 1948) method. After determining the D-value, discrimination value, for each item, a frequency distribution of D-values of items in the initial examination was prepared. Lawshe (1948) recommended that test items of D-value less than 0.3 or 0.4 be omitted or revised, therefore, those test items of poor discriminatory value, D-value less than 0.4, were either omitted or revised. The revised examination consisted of 80 items.

A correlation analysis between number of years experience in foods and waiver examination scores was performed to test the null hypothesis that there was no relationship between the number of years of experience in foods work and student performance on the waiver examination.

The effect of the type of experience in food preparation (for example, 4-H program training and high school foods courses or both) on waiver examination score was evaluated by calculation of mean waiver examination scores.
Use of waiver examination on trial basis

The revised examination was used as a waiver device fall quarter of 1965 on a trial basis. A laboratory preparation portion of the examination was used at this time in conjunction with the written theory examination. It was felt that it would be desirable to give the student the opportunity to exhibit his preparation skills. However, as Steelman and Barbour (1965) point out, there was a problem of scheduling as well as time and expense required to administer the practical portion of the examination. It was also very difficult to differentiate between the knowledge of a principle of preparation and the skill with which a student performs a particular procedure. Since it was the knowledge of the principle which was of prime importance, the laboratory examination should be more skillfully constructed. It was decided to omit the laboratory examination.

Administration of revised examination

During the author's two year absence from the campus, the food and nutrition faculty again reviewed the initial test and made suggestions for needed revisions. These suggestions together with the statistical analysis were used to further refine the revised test. In an attempt to compensate for deletion of a laboratory practical portion of the examination, two essay questions were added to give the students opportunity to respond to a cooked product failure situation. Students were asked to tell what could have happened to cause the product failure.
The revised examination was administered to 34 students enrolled in Food and Nutrition 23 fall quarter of 1967, the first day of class, with the intent of verifying the validity of the revision process.

**Evaluation of initial vs revised examination**

The numerical score for the waiver examination and total numerical score for the quarter, representing final grade in the course, were recorded for each student in each of the two groups.

A correlation analysis as described by Ostle (1963) was performed between the numerical score for the examination and total numerical score for the quarter for each of the two groups. A linear regression was also computed to obtain the linear regression equation which may be used in a predictive manner in determining an equivalent course score knowing a waiver examination score. This predictive quality of the regression equation was used to determine the "pass-fail" point.
RESULTS AND DISCUSSION

Results of evaluation of initial examination

Results of the analysis of the initial examination for item discrimination are presented in Table 2 in the form of a frequency distribution of D-values of items in the initial test. Those items which had a D-value of less than 0.4 were either revised or omitted for use in the revised examination.

In Table 3 is presented the percentage of students having each of the different kinds of experience in foods. It was noted that some students indicated experience in all three areas specified.

The coefficient of correlation value, r, obtained from the correlation analysis of years experience in foods with waiver examination score was 0.31, which was not statistically significant at $P<0.05$. There was apparently no relationship between number of years of experience in foods and the waiver examination score. It was possible that depth of knowledge of basic food preparation principles was more important in determining the waiver examination score than number of years of experience alone. Wangsgard's (1958) results tended to corroborate this finding.

In Table 4 is presented the mean waiver examination scores, determined for the kinds of experience in food preparation listed by students who took the initial examination. The mean scores were calculated separately for the students enrolled in the basic foods course and the remaining students who were enrolled in the basic psychology and child development courses.
Table 2. Frequency distribution of D-values for initial test items

<table>
<thead>
<tr>
<th>D-value</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3</td>
<td>1</td>
</tr>
<tr>
<td>2.2</td>
<td>3</td>
</tr>
<tr>
<td>2.1</td>
<td>1</td>
</tr>
<tr>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>1.8</td>
<td>2</td>
</tr>
<tr>
<td>1.7</td>
<td>1</td>
</tr>
<tr>
<td>1.6</td>
<td>3</td>
</tr>
<tr>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>1.4</td>
<td>5</td>
</tr>
<tr>
<td>1.3</td>
<td>3</td>
</tr>
<tr>
<td>1.2</td>
<td>4</td>
</tr>
<tr>
<td>1.1</td>
<td>2</td>
</tr>
<tr>
<td>1.0</td>
<td>6</td>
</tr>
<tr>
<td>0.9</td>
<td>1</td>
</tr>
<tr>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>0.7</td>
<td>5</td>
</tr>
<tr>
<td>0.6</td>
<td>9</td>
</tr>
<tr>
<td>0.5</td>
<td>10</td>
</tr>
<tr>
<td>0.4</td>
<td>9</td>
</tr>
<tr>
<td>0.3</td>
<td>5</td>
</tr>
<tr>
<td>0.2</td>
<td>4</td>
</tr>
<tr>
<td>0.1</td>
<td>3</td>
</tr>
<tr>
<td>0.0</td>
<td>7</td>
</tr>
<tr>
<td>-0.1</td>
<td>0</td>
</tr>
<tr>
<td>-0.2</td>
<td>2</td>
</tr>
<tr>
<td>-0.3</td>
<td>0</td>
</tr>
<tr>
<td>-0.4</td>
<td>1</td>
</tr>
<tr>
<td>-0.5</td>
<td>1</td>
</tr>
</tbody>
</table>

Total 97
Table 3. Students with previous experience in foods

<table>
<thead>
<tr>
<th>Source of previous experience in foods</th>
<th>Percentage of 25 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>76 %</td>
</tr>
<tr>
<td>Home</td>
<td>68 %</td>
</tr>
<tr>
<td>4-H programs</td>
<td>20 %</td>
</tr>
<tr>
<td>Other</td>
<td>4 %</td>
</tr>
<tr>
<td>None</td>
<td>8 %</td>
</tr>
</tbody>
</table>

Combined experiences

<table>
<thead>
<tr>
<th>Experience Source</th>
<th>Number of Students</th>
<th>Mean Waiver Exam. Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home + school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home + school + 4-H</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Mean waiver examination scores for students with different kinds of experience in food preparation

<table>
<thead>
<tr>
<th>Experience Source</th>
<th>Number of Students</th>
<th>Mean Waiver Exam. Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>Introd. Foods 19</td>
<td>78.6</td>
</tr>
<tr>
<td></td>
<td>Other 47</td>
<td>72.8</td>
</tr>
<tr>
<td>4-H Program</td>
<td>Introd. Foods 5</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>Other 22</td>
<td>73.8</td>
</tr>
<tr>
<td>School + 4-H</td>
<td>Introd. Foods 5</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>Other 21</td>
<td>75.3</td>
</tr>
</tbody>
</table>
It was noted that mean examination scores for each of the different types of experience did not differ more than three points within either of the two groups of students. Apparently one type of experience in food preparation did not have any real affect on the waiver examination score more than another type of experience in food preparation. There was a trend toward higher mean waiver examination scores in those students who were enrolled in the basic foods course. Apparently interest in foods was a factor affecting the waiver examination score.

Results of evaluation of initial vs revised examination

Pairs of raw scores for each of the two groups used in the correlation analysis are presented in Table 5. For clarity and ease in discussion of the results, the pairs of scores obtained from the spring quarter 1965 students will be referred to as Group I and the pairs of scores obtained from the fall quarter 1967 students will be referred to as Group II.

Results of the correlation analysis discussed in the procedure are presented in Table 6. The X or independent variable was the waiver examination score, and the Y or dependent variable was the total numerical score in the course.

Discussion of results

Although it was not the main intent of this study to measure the magnitude of the correlation between waiver examination and final score, such a relationship was assumed to exist in one of the initial hypotheses.

The $r$, coefficient of correlation, for Group I is 0.412 which was significant.
Table 5. Raw scores for each of the two groups used in correlation analysis

<table>
<thead>
<tr>
<th>Student Number</th>
<th>Waiver Exam. Score</th>
<th>Final Course Score&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Student Number</th>
<th>Waiver Exam. Score</th>
<th>Final Course Score&lt;sup&gt;*&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>92</td>
<td>258.5</td>
<td>201</td>
<td>85</td>
<td>736</td>
</tr>
<tr>
<td>102</td>
<td>90</td>
<td>266.5</td>
<td>202</td>
<td>84</td>
<td>790</td>
</tr>
<tr>
<td>103</td>
<td>89</td>
<td>266.5</td>
<td>203</td>
<td>80</td>
<td>754</td>
</tr>
<tr>
<td>104</td>
<td>89</td>
<td>230.5</td>
<td>204</td>
<td>80</td>
<td>744</td>
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<tr>
<td>105</td>
<td>87</td>
<td>258.5</td>
<td>205</td>
<td>79</td>
<td>741</td>
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<tr>
<td>106</td>
<td>85</td>
<td>236.5</td>
<td>206</td>
<td>79</td>
<td>515</td>
</tr>
<tr>
<td>107</td>
<td>84</td>
<td>250.5</td>
<td>207</td>
<td>78</td>
<td>751</td>
</tr>
<tr>
<td>108</td>
<td>83</td>
<td>256.0</td>
<td>208</td>
<td>77</td>
<td>647</td>
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<tr>
<td>109</td>
<td>82</td>
<td>220.0</td>
<td>209</td>
<td>77</td>
<td>759</td>
</tr>
<tr>
<td>110</td>
<td>80</td>
<td>237.0</td>
<td>210</td>
<td>77</td>
<td>682</td>
</tr>
<tr>
<td>111</td>
<td>80</td>
<td>216.0</td>
<td>211</td>
<td>74</td>
<td>715</td>
</tr>
<tr>
<td>112</td>
<td>78</td>
<td>246.0</td>
<td>212</td>
<td>74</td>
<td>725</td>
</tr>
<tr>
<td>113</td>
<td>77</td>
<td>257.5</td>
<td>213</td>
<td>72</td>
<td>789</td>
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<td>77</td>
<td>192.0</td>
<td>214</td>
<td>69</td>
<td>752</td>
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<tr>
<td>115</td>
<td>76</td>
<td>204.5</td>
<td>215</td>
<td>68</td>
<td>733</td>
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<tr>
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<td>75</td>
<td>223.5</td>
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<tr>
<td>117</td>
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<tr>
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<td>74</td>
<td>250.0</td>
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<td>64</td>
<td>696</td>
</tr>
<tr>
<td>119</td>
<td>73</td>
<td>243.0</td>
<td>219</td>
<td>64</td>
<td>712</td>
</tr>
<tr>
<td>120</td>
<td>71</td>
<td>237.0</td>
<td>220</td>
<td>63</td>
<td>533</td>
</tr>
<tr>
<td>121</td>
<td>70</td>
<td>219.5</td>
<td>221</td>
<td>62</td>
<td>774</td>
</tr>
<tr>
<td>122</td>
<td>69</td>
<td>205.5</td>
<td>222</td>
<td>59</td>
<td>779</td>
</tr>
<tr>
<td>123</td>
<td>66</td>
<td>229.5</td>
<td>223</td>
<td>59</td>
<td>657</td>
</tr>
<tr>
<td>124</td>
<td>60</td>
<td>176.0</td>
<td>224</td>
<td>58</td>
<td>593</td>
</tr>
<tr>
<td>125</td>
<td>49</td>
<td>254.5</td>
<td>225</td>
<td>58</td>
<td>654</td>
</tr>
</tbody>
</table>

<sup>a</sup>Represents the final numerical score in Food and Nutrition 23, numerical equivalent to student's final grade in the course.
Table 6. Results of correlation and regression analysis of examination scores and total course score

<table>
<thead>
<tr>
<th>Group</th>
<th>$\sum (X - \bar{X})^2$</th>
<th>$\sum (X - \bar{X})(Y - \bar{Y})$</th>
<th>$\sum (Y - \bar{Y})^2$</th>
<th>Sum Squares Due to Reg.</th>
<th>Sum Square Dev. from Reg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2350.56</td>
<td>2314.9</td>
<td>13439.7</td>
<td>2279.780</td>
<td>11159.919</td>
</tr>
<tr>
<td>II</td>
<td>4577.45</td>
<td>17227.1</td>
<td>107831.0</td>
<td>64834.441</td>
<td>142996.560</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>$b_0$</th>
<th>$b_1$</th>
<th>$\frac{\sum}{E}$</th>
<th>$r^2$</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>158.110</td>
<td>0.9848</td>
<td>485.213</td>
<td>0.16963</td>
<td>0.412*</td>
</tr>
<tr>
<td>II</td>
<td>433.386</td>
<td>3.7630</td>
<td>4468.640</td>
<td>0.31196</td>
<td>0.558**</td>
</tr>
</tbody>
</table>

* Significant at 5 per cent level
** Significant at 1 per cent level

at the 5 per cent level and $r$ for Group II is 0.558 which was significant at the 1 per cent level. This indicated that there was a statistically significant relationship between the waiver examination score and final numerical score in the introductory foods course.

It was likely that several factors contributed to low $r^2$, coefficient of determination, values for both groups. These factors might be individual student differences and teacher differences. Since these factors were confounded, any real conclusion as to the reason for low $r^2$ values was difficult to make.

Validity of the revision process was determined by a correlation analysis. The $r^2$ for Group I was 0.16963 or 16.96 per cent of the variability in the final numerical score can be predicted by knowledge of the waiver examination score. The $r^2$ for Group II was 0.31196 or the indication that
31.196 per cent of the variability in the final examination score can be predicted by knowledge of the waiver examination score. The indication was that since the degree of correlation improved, the revision process was apparently successful in producing a more valid examination.

The predictive quality of the regression equation has been discussed by several authors, (including, Tate, 1955, 1965; and Ostle, 1963). The regression equation derived from the statistical analysis, based on the revised examination is as follows:

\[
\hat{Y} = 433.386 + 3.763(X)
\]  

Equation (1) may be used in predicting an estimated course score using the waiver examination score X. A \( \hat{Y} \) value (estimated course score) may be calculated in the following manner:

Assume the waiver examination score (X) obtained was 78 out of 110 possible points and that the maximum number of points for the quarter in the foods course was 900.

\[
\hat{Y} = 433.386 + (3.763)(78)
\]
\[
\hat{Y} = 433.386 + 293.514
\]
\[
\hat{Y} = 726.9
\]

It was interesting to note that none of the waiver examination scores in Group I or Group II exceeded or met the 80 per cent "cut-off" point suggested in the recommendations. When mean examination scores were compared with the letter final grade in the introductory foods course for Group I, the lower mean examination scores were found to
coincide with lower final grade in the foods course. Conversely, higher mean examination scores coincided with higher final grade in the foods course. The same tendency was noted in Group II with the exception that the mean waiver examination score (62) for those students receiving a D grade in the course was higher than the mean waiver examination score (55.9) for those students receiving a C grade in the foods course. This would tend to cause concern with regard to the motivation and study habits of some students in the introductory foods course.

Students exempt from introductory foods course by use of the waiver examination

The revised examination has been adopted by the Department of Food and Nutrition at Utah State University and has been in use since September 1965. Students may take the waiver examination upon their own request or on the advice of their faculty advisor.

Thirty-four (34) students have taken the waiver examination since its adoption in 1965, with 25 students being exempted from the introductory foods course. Since the foods courses are not always taken in sequence of quarters, the number of students completing subsequent foods courses is not sufficient to make a study of success of exempted students in more advanced foods courses.
SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to develop and evaluate a waiver examination for the introductory foods course (Food and Nutrition 23) to be used by the Department of Food and Nutrition at Utah State University.

An initial examination of 100 items was constructed, administered to 100 students, and statistically analyzed for item discrimination using the Lawshe nomograph method.

Students enrolled in Food and Nutrition 23 spring quarter of 1965 were part of the 100 students. The students were asked to indicate the number of years experience in foods at home, at school, and in 4-H programs.

The examination was revised using the statistical analysis and faculty suggestions as basis for omitting or revising those test items of poor discriminatory value.

Scores for initial examination and total numerical score in the course, and scores for revised examination and total numerical course score were obtained from two different groups of students enrolled in the introductory foods course (Food and Nutrition 23). The pairs of scores for each group were submitted to correlation analysis for the purpose of determining the validity of the revision process and determining the degree of relationship between waiver score and final course score.
Correlation analysis was also used to measure the degree of relationship between number of years of experience in food preparation and waiver examination score. The coefficient of correlation, $r$, was 0.31.

The coefficient of determination, $r^2$, for the correlation analysis of the pairs of scores for waiver examination and final course score for Group I was 0.16963 and for Group II was 0.31196.

The regression equation obtained for Group II can be used in a predictive manner in estimating a course score from a known waiver examination score, provided that the waiver score falls within the point range of 40 to 85.

**Conclusions**

It was concluded, on the basis of the correlation analysis that the revision process was apparently successful. There was a significant relationship between waiver examination score and final numerical course score in the introductory foods course.

There was no statistically significant relationship between number of years of experience in food preparation and waiver examination score. The type of experience in food preparation did not seem to cause any real differences in the waiver examination score. Apparently depth of knowledge of basic food preparation principles was a more important factor than just years or breadth of experience (skill) in contributing to the waiver examination score. Depth of knowledge of basic food preparation principles implies an understanding of how and why foods react as they do under various conditions.
Recommendations

It is recommended that the waiver examination developed as a result of this study be adopted for use by the Department of Food and Nutrition for the purpose of waiving the introductory foods course for those students who successfully complete the examination. It is suggested that successful completion of the examination be interpreted as a grade of 80 per cent or above. This recommendation is made on the condition that the examination be continually revised and improved as course objectives and curriculum for the introductory foods work are re-evaluated from time to time.

The "problem solving" essay answer type questions used should be revised and increased in number to 4 or 5. In addition, the essay questions should be changed periodically to ensure the objectiveness of the examination.

An additional recommendation which came about as a result of the student responses to the two "problem solving" essay answer type questions is, that the curriculum for the introductory foods work be re-evaluated.

The need for re-evaluation of the home economics curriculum has been a cause of concern to several authors in the field, (including, Bakkie, 1958; Lehman, 1959, and Ricks, 1962). Bakkie (1958) stressed the importance of recognizing the need for new approaches and new methods.

The question has been raised, as a "by-product" of this study, as to whether the present curriculum for the introductory foods work
is as complete in its attention to new methods, new procedures, and new products now available to the consumer as it could be. Additional study in this aspect is suggested.
LITERATURE CITED


Ricks, Victor E. 1962. Evaluation in times such as these. Journal of the American Dietetic Association 41:187-190.


APPENDIX
I. Matching:
Match the following terms with the proper definition for each term. A term will be used only once.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To combine shortening or other fat with sugar until the mixture is light and completely blended, or to soften one or more foods. A. Braise</td>
</tr>
<tr>
<td>2.</td>
<td>To allow a food to stand in a liquid--usually French Dressing or a mixture of oil and vinegar--for flavor and tenderness. E. Steam</td>
</tr>
<tr>
<td>3.</td>
<td>To beat rapidly to incorporate air and increase volume. H. Whip</td>
</tr>
<tr>
<td>4.</td>
<td>To brown in a small amount of hot fat, then add a small amount of liquid and cook slowly in a tightly covered utensil on top of range or in oven. J. Toss</td>
</tr>
<tr>
<td>5.</td>
<td>To mix ingredients together lightly.</td>
</tr>
<tr>
<td>6.</td>
<td>To combine ingredients, usually by stirring.</td>
</tr>
<tr>
<td>7.</td>
<td>To distribute shortening through dry ingredients, leaving the shortening in small particles.</td>
</tr>
<tr>
<td>8.</td>
<td>To cook by direct exposure to flame or coals or electric heating units.</td>
</tr>
<tr>
<td>9.</td>
<td>To combine a solid ingredient with a delicate substance such as beaten egg white without loss of air.</td>
</tr>
<tr>
<td>10.</td>
<td>To cook in liquid, usually at a temperature just below the boiling point.</td>
</tr>
<tr>
<td>11.</td>
<td>To cook in direct contact with steam in a closed container.</td>
</tr>
</tbody>
</table>

Match the product with its leavening agent. A leavening agent may be used more than once.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>Butter cake</td>
</tr>
<tr>
<td>13.</td>
<td>Angel food cake</td>
</tr>
<tr>
<td>14.</td>
<td>Biscuits</td>
</tr>
<tr>
<td>15.</td>
<td>Muffins</td>
</tr>
<tr>
<td>16.</td>
<td>Popovers</td>
</tr>
<tr>
<td>17.</td>
<td>Bread</td>
</tr>
</tbody>
</table>
Match the method of preparation with the general type of meat cookery. A method may be used more than once.

18. Braise
   A. Dry

19. Broil
   B. Moist

20. Stew
   C. Dry and Moist

21. Steam
22. Bake
23. Fry
24. Pan Broil
25. Roast
26. Fricassee

II. Multiple choice:
In the following questions, select the answer which is most correct or completes the question in the best way. Place the letter of the choice selected in the blank to the left of the question.

27. To measure one cup of pre-sifted flour, one would use:
   a. one of nested measuring cup set (without lip).
   b. a glass measuring cup with a lip for pouring.
   c. a teacup.

28. Mary needs to level off the cup of flour she has just measured. She should use:
   a. a paring knife.
   b. a spatula.
   c. the hand.

29. A recipe contains the following proportions of ingredients: 1 cup liquid, 1 to 4 T. fat, and 1 to 4 T. flour. You would expect the final product to be:
   a. biscuits.
   b. a white sauce.
   c. pancakes.
   d. a cooked salad dressing.

30. A recipe contains the following proportions of ingredients: 1 cup sugar, 1/2 cup fat, 2/3 cup liquid, 2 cups flour, 2 eggs and a leavening agent. You would expect the final product to be:
   a. a sponge cake.
   b. bread.
   c. biscuits.
   d. a butter cake.
31. A recipe contains the following proportions of ingredients: 1 cup flour, 1/3 cup fat, and 3 to 4 T. liquid. You would expect the final product to be:
   a. biscuits.
   b. pie crust.
   c. muffins
   d. bread.

32. A recipe contains the following proportions of ingredients: 2 cups flour, 1 cup liquid, 1 egg, 4 T. fat, 4 T. sugar and a leavening agent. You would expect the final product to be:
   a. biscuits
   b. pie crust.
   c. popovers
   d. muffins.

33. A recipe contains the following proportions of ingredients: 1 cup flour, 2 T. solid fat, 1/2 cup liquid and a leavening agent. You would expect the final product to be:
   a. a white sauce.
   b. bread.
   c. biscuits.
   d. waffles.

34. A recipe contains the following proportions of ingredients: 1 cup flour, 1-1/4 cups sugar, 1 cup egg whites and flavorings. You would expect the final product to be:
   a. angel food cake.
   b. sponge cake.
   c. cookies.
   d. a meringue shell.

35. A recipe gives the following proportions of ingredients: 4 cups flour, 1 cup liquid, 2 T. sugar, 2 T. fat, and a leavening agent. You would expect the final product to be:
   a. biscuits.
   b. sweet yeast bread.
   c. bread.
   d. muffins.

36. Double acting baking powder acts twice, these actions occur
   a. primarily when liquid is added.
   b. primarily when mixed with dry ingredients.
   c. primarily when heated.
37. Single acting baking powder acts
   a. primarily when heated.
   b. primarily when mixed with dry ingredients.
   c. primarily when liquid is added.

38. Which of the following fats is NOT 100 per cent fat?
   a. butter.
   b. lard.
   c. vegetable oil.
   d. shortening.

III. Matching:
   Match the following flours with the appropriate baked product. A flour may be used more than once.

   39. Spaghetti
   40. Angel food cake
   41. Bread
   42. Biscuits
   43. Muffins
   44. Pie crust
   45. Butter cake

   Match the following equivalents with the appropriate definition for each term.

   46. 1 cup
   47. 3/4 cup
   48. 1 quart
   49. 2 cups
   50. 1 tablespoons

IV. Multiple choice:
   In the following questions, select the answer or answers which are most correct or complete the question in the best way.

   51. Indicate the procedures that would be used in making a cake by the conventional cake method. Indicate the order in which they are performed by numbering 1, 2, 3, etc.
       _____ add the flour and sugar alternately.
       _____ add flour and liquid alternately.
       _____ cream shortening and add sugar gradually.
       _____ cream sugar and eggs, then add shortening.
       _____ add eggs one at a time.
52. Indicate the procedures that would be used in making muffins by the muffin method. Indicate the order in which they are performed by numbering 1, 2, 3, etc.

- add all liquid ingredients to dry ingredients.
- stir vigorously.
- sift together all dry ingredients.
- add liquid fat to eggs and milk.
- stir until dry ingredients are just moistened.
- cream shortening and sugar.

53. Indicate the procedures that would be used in making a pie crust by the standard pastry method with lard. Indicate the order in which they are performed by numbering 1, 2, 3, etc.

- cream fat.
- cut fat into dry ingredients.
- add water all at once.
- sift dry ingredients together.
- add water slowly--small amounts at a time.

54. To obtain the most mild flavor when cooking cabbage, the lid of the pan would be:
   a. left on all the cooking time.
   b. left off all the cooking time.
   c. left off part of the cooking time.

55. Most generally, vegetables should be cooked in:
   a. a large amount of water.
   b. a very small amount of water.
   c. just enough water to cover them.

56. At the beginning of the cooking period, vegetables are usually placed in:
   a. boiling water.
   b. cold water.
   c. lukewarm water.

57. The current thought is that most vegetables are best if they are cooked until:
   a. very soft and mushy.
   b. tender but firm.
   c. just warmed through.
58. The most desirable method for crisping salad greens is:
   a. soaking in cold water.
   b. placing them in the freezer for a few minutes.
   c. placing in the refrigerator in a plastic bag and in the crisper for 1 hour or more.

59. Which of the following does NOT describe a standard muffin?
   a. a slightly rough, pebbled top.
   b. a close, fine grain with thin cell walls.
   c. a rough texture with moderately thick cell walls.

60. Which of the following characteristics does NOT describe the standard pie crust?
   a. a flaky texture.
   b. a smooth, even appearance.
   c. tender.
   d. a blistered, golden brown appearance.
   e. even browning of the crust.

61. Which of the following does NOT describe a standard loaf of bread?
   a. a close, even grain.
   b. thick cell walls.
   c. thin cell walls.
   d. smooth rounded top.
   e. even browning of the crust.

62. Which of the following characteristics does NOT describe the standard butter cake?
   a. uniform texture.
   b. small, thin-walled cells.
   c. velvety crumb.
   d. slightly pebbled top.
   e. compact texture.

63. Which of the following characteristics does NOT describe the standard rolled biscuit?
   a. pebbly, uneven top crust.
   b. flaky, most texture.
   c. tender and somewhat crisp.

64. Which of the following cuts of meat is NOT prepared by a dry heat method?
   a. rolled rib roast.
   b. T-bone steak.
   c. lamb chop.
   d. round steak.
65. Which of the following cuts of meat is **NOT** prepared by a moist heat method?
   a. chuck roast.
   b. flank steak.
   c. pork chop.
   d. top-sirloin steak.
   e. beef shanks.

66. Cornstarch puddings are cooked:
   a. until just thickened.
   b. 2 to 3 minutes after thickening.
   c. 5 to 10 minutes after thickening.

67. Which one of the following methods should **NOT** be used to add egg to a hot paste mixture?
   a. mix a little of the hot paste with the egg.
   b. put the egg into the hot paste mixture.
   c. remove hot paste mixture from stove, allow it to cool, then stir in egg.

68. Which of the following methods should **NOT** be used to add starch to a hot liquid?
   a. add a small amount of hot liquid to the starch and make a paste.
   b. add cold water to the starch and make a paste.
   c. add starch to melted fat and then add hot liquid.
   d. add starch to sugar and add hot liquid.
   e. rapidly stir dry starch into hot liquid mixture.

69. Some of the following products should be kneaded in order to produce a fine, desirable texture in the finished product. They are:
   a. pie crust.
   b. muffins.
   c. yeast bread.
   d. cookies.
   e. rolled biscuits.

70. Some of the following products, because of their high fat, liquid, or sugar content are not affected a great deal by handling. They are:
   a. popovers.
   b. biscuits.
   c. butter cookies.
   d. pie crust.
71. Salad fruits tend to brown when peeled or cut. The most effective method for preventing browning is by:
   a. dipping in citrus juice.
   b. placing in salt water.
   c. peeling just before serving.
   d. sprinkling the pieces with sugar.

72. Regular rice when cooked, increases its volume about:
   a. 3 times.
   b. 4 times.
   c. 2-1/2 times.
   d. twice.

73. Macaroni and spaghetti, when cooked, increase in volume about:
   a. 3 times.
   b. 2 times.
   c. 4 times.
   d. 2-1/2 times.

74. Plain gelatin, when soaked in cold water:
   a. swells or becomes hydrated.
   b. does not change.
   c. dissolves.
   d. sets.

75. Plain gelatin, after being soaked in cold water and when added to hot water:
   a. swells or becomes hydrated.
   b. sets.
   c. does not change.
   d. dissolves.

76. Egg dishes are not usually cooked at the following temperature range to achieve the most desirable product.
   a. 300-350° F.
   b. 350-400° F.
   c. 400-450° F.

77. Meats are cooked with less shrinkage at the following temperature range:
   a. 350-400° F.
   b. 300-350° F.
   c. 400-450° F.
78. Milk dishes are usually cooked at a low temperature:
   a. so the product will cook quickly.
   b. so the calcium in the milk isn't destroyed.
   c. to prevent curdling of the proteins.

V. Essay:

79. Your neighbor, Mrs. Jones, made an egg custard. Her product was porous and leaking. She wanted to know what errors she may have made. What would you tell her?

80. Jane moved to Logan from Portland, Oregon. She made a butter cake yesterday, it fell. What are the possible reasons why her cake fell? Explain.
VITA

Virginia Clark Bragg

Candidate for the Degree of

Master of Science

Thesis: Development and Evaluation of a Waiver Examination for the Introductory Foods Course at Utah State University.

Major Field: Food and Nutrition

Biographical Information:


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Professional Experience: staff dietitian (therapeutic) and chief therapeutic dietitian at Latter-day Saints Hospital, Salt Lake City, Utah, June 1965- November 1965, June 1966- December 1966; teaching graduate assistant for Department of Foods and Nutrition at Utah State University, 1964-65 school year; staff dietitian (therapeutic) at The Swedish Hospital, Seattle, Washington, 1962-64.