집단 급식소 재고 관리 시스템에 관한 자기학습식 Module의 타당성 검증

Validation of a Self-instructional Foodservice Inventory Control System Module

연세대학교 생활과학대학 식품영양학과
조교수 양 일 선
미국 Iowa 주립대학 급식경영학과
교 수 Finley, DoriAnn
미국 Iowa 주립대학 가정교육학과
교 수 Fanslow, Alyce M

Dept. of Food & Nutrition, Yonsei Univ.
Aissistant Prof. : Yang, Il Sun
Dept. of Hotel, Restaurant, and Institution Management, Iowa state Univ.
Prof. : DoriAnn H. Finley
Dept. of Family and Consumer Sciences Education, Iowa state Univ.
Prof. : Alyce M. Fanslow

국문초록

본 연구의 목적은 1) 집단 급식소의 재고 관리 시스템에 관한 자기학습식 Module(Self-instructional Module)을 개발하고, 2) 비동등 통제 실험 연구 디자인(Nonequivalent Control group research design)을 사용하여 자기학습식 재고 관리 시스템 Module의 교육적 효과를 평가하여, 3) 교육기관 및 집단 급식소에서의 교육용 교재로서의 타당성 여부를 검증하고자 함이다.

집단 급식소의 재고 관리 시스템에 관한 자기학습식 Module을 개발하기 위해서 현재 미국 전역의 가정대학 내의 식품영양 및 급식경영학과에서 재고 관리에 관련된 교과목을 위하여 채택되어 사용되어지고 있는 주요 교과서들의 내용 분석과 급식경영학 전공 교수 3인의 판단에 기초를 두어 재고관리에 포함되어야 할 내용이 분석되었다. 포함되어져 있는 내용의 목차는 반입(receiving), 저장(storing), 출고(issuing), 재고통제(inventory control), 재고의 자산적 가치(inventory valuation) 및 재고관리 시스템의 자동화(inventory control computer system)등이다.

실험 대상은 Iowa 주립대학에서 급식정보관리(Foodservice Management Information System) 과목을 수강하였던 88명의 학생이며, 강의를 통해 수업을 받은 통제집단 46명과, 자기 학습식 Module을 사용했던 실험집단 42명으로 구성되었다. 모든 실험 대상에게는 사전검사(Pretest)와 사후검사(posttest)를 실시하였으며 자료의 처리는 SPSS PC Package를 이용하여 공분산 분석(Analysis of covariance)의 통계법으로 분석하였다.

연구결과는 강의 중심의 통제집단과 자기학습식 Module을 사용했던 실험집단 간의 통제 후 평균 값(posttest adjusted mean score) 사이에는 유의적인 차이를 보였으며 ($p<0.05$), 자기 학습식 Module 그룹에 속해 있던 학생들이 더 높은 통제 후 평균값(adjusted mean score)을 보여 주었다. 그러므로, 이

실험을 통하여, 개발된 집단 급식소 재고관리 시스템에 관한 자기학습식 Module은 학생들에게 재고관리 시스템에 관한 개념과 내용의 습득력을 향상시키는데 있어서 적어도 강의식 교수법과 동일하거나 더 나은 교육적 효과를 가져왔다고 판단되었다.

Ⅰ. INTRODUCTION

An inflation continues to affect the economy, increased food prices inflate the investment of foodservice operations in their inventories. This trend forces foodservice and dietetic managers towards centralization of purchasing, attempts to predict demand, and management of inventory in an effort to contain costs. As pressures for cost containment have increased in all types of foodservice operations, dietitians and foodservice managers must become more cost conscious and efficient in resource management to attain desired performance outcomes.[1]

The skills and characteristics essential to managerial effectiveness involve acquisition of management science techniques. One of the important management science techniques is inventory control; effective inventory control has become essential to foodservice operations under this economy because an effective inventory control system ensures that supplies are purchased at minimum cost while desired qualities are maintained.

Evidence supporting the importance of inventory control is found in a study by Finley and Kim[2]. They surveyed directors of health care foodservice systems concerning the use of 17 management science techniques and found that inventory control is the most important and valuable of the management science techniques. They also indicated that the major problem areas facing the foodservice managers today is cost and production control.

The need for foodservice managers to use inventory control systems is also supported by the minimum competencies identified for entry-level dietitians and beginning foodservice managers[3][4]. Buergermeister[5] surveyed 150 members of the Council on Hotel, Restaurant, and Institutional Education(CHRIE) concerning the important competencies for beginning managers. The findings indicated that technical skills in inventory control are highly desirable for beginning managers in hospitality industry.

Although theory for inventory control in business is well developed the application of inventory control to foodservice operations is just beginning. This gap will narrow as educational institutions integrate inventory control techniques into their courses[6].

One approach to teaching inventory control techniques is self-instruction. Unlike teacher-directed instruction, self-instruction focuses on the individual student. In the self-instructional approach, educators provide the tools but the individual is responsible for his/her own learning. Programs can be used with many types of students and subject matters, either by themselves or in combination with other instructional programs. The teaching technique based on self-instructional programs is called programmed instruction(PI)[7].

In the relatively short time since programmed instruction was introduced in the 1970s, many schools, institutions, and industries have used this technique[8][11]. Self-instruction offers many advantages. Each individual receives the same quality of standardized information, not dependent on the knowledge, teaching skills, or available time of the instructor. The student participates in a guided program of self-study that is pursued independently. The programmed material enables the students to know immediately whether their responses are correct and students progress at their own rate of speed[12].

Due to the multi-dimensional responsibilities of foodservice managers work in a variety of practice settings and their critical need for continuing education within limited time parameters, self-instruction offers a sound alternative to traditional forms of instruction[13]. The self-instruction program can be studied as desired during the manager's free time which sporadically arises within his/her respective schedules. Therefore, a well-prepared self-instruction program offers help to

busy dietitians and foodservice managers to not only acquire the basic factual knowledge but also to apply knowledge to their professional life situations.

In an attempt to use programmed instruction in dietetic and foodservice education, several dietetic and foodservice educators have found the use of self-instructional packages equally as good as traditional instructional methods[14][16]. Although some research has been conducted on self-instructional programs with effective results in dietetic and foodservice management education, no educational programs have been developed on inventory control for dietetic and foodservice management students and practitioners in foodservice operations.

Ⅱ. METHOD

The purposes of this study were to (1) develop a self-instructional module on inventory control, and (2) evaluate the self-instructional foodservice inventory control system module using a nonequivalent control group design.

1. Experiment treatments

The experimental treatments used in the study were lecture and self-instruction. A self-instructional module entitled, "Inventory Control System Self-Instructional Module", was developed[17]. The module was divided into six sections with a total of 228 frames. The content areas were identified from a content analysis of inventory control systems using textbooks and consultation with Hotel, Restaurant, and Institution Management department faculty at Iowa State University. Textbooks used were by Dittmer and Griffin[18], Spears and Vaden[19], Powers and Powers[20], Stefanelli[21], West, Wood, Harger, and Shugart[22], Peddersen[23], Knight and Kotschevar[24], and Kasavana[25].

The content areas identified were receiving, storing, issuing, inventory control, inventory valuation, and inventory control computer system. All content areas were divided into the cognitive domains: knowledge and comprehension, application and analysis, and synthesis and evaluation. Objectives for each content area were developed at each cognitive level. A panel of three faculty members verified the accuracy of the objectives. Therefore, in this self-instructional module, complex levels of learning are included. As such, the module overcomes the inherent weakness of most programmed instruction units that only knowledge objectives are included[26].

For the lecture group on inventory control systems, the six content areas were presented from outlines developed for the self-instructional module. Questions were answered as they arose, and a reading assignment supplemented the lectures.

2. Instrumentation

Devices used in this study consisted of an achievement test and an attitude inventory. Each of these devices was developed specifically for this study.

The achievement test was developed from a table of specifications and based on the content areas of the module. The achievement test consisted of 114 multiple-choice items, each with a single correct response. A panel of three faculty members verified the accuracy of the content of the test items. Evaluation specialists examined each test item for adherence to item-writing principles.

The test was administered to 105 students following instruction in inventory control techniques. Difficulty and discrimination indices were calculated. The best 50-items were selected for the final form of the inventory control test. Dual criteria were used for selection of items. The first criterion was adherence to the table of specifications, and the second, the selection of an item with a difficulty index between 30 and 70% in conjunction with a discrimination index > 0.20[27].

The Kuder-Richardson formula 20 was used to calculate the reliability coefficient of the 50-item test. The reliability was 0.84, above the recommended 0.70

if the test is used in basic research[28].

An instrument, Attitudes toward Inventory Control System Module, was developed to measure student responses toward the inventory control system self-instructional module. The seventeen items were stated positively and negatively. A nine-point scale of agree and disagree was used with 1 being strongly disagree and 9 being strongly agree. The response pattern was reversed for the items that described nondesirable characteristics of the self-instructional module so that a high score would indicate positive feelings toward the module.

The content validity of the attitude scale statements was established through the use of a panel of experts. The reliability coefficient of the total scale was 0.90 using the coefficient alpha procedure.

Questions were developed to obtain demographic information from the subjects. The questions requested information about the subjects' sex, age, academic class standing, academic major, college grade point average (GPA), and work experience in foodservice.

3. Experiment

A nonequivalent control group design was used for this study. The experimental treatments were lecture and self-instruction. The researcher selected two consecutive, 90-minute class periods in which the inventory control unit was to be taught.

The pretest and demographic data were collected at the beginning of each semester, The posttest was administered after each experimental treatment. The self-instruction group also responded to an attitude inventory.

The inventory control system self-instructional module was utilized by the self-instructional group. Students studied the self-instructional module independently during the two, 90-minute class periods. Students were allowed to study the module between the second class period and the posttest.

Students in the lecture method were instructed via lecture plus assigned readings. These students also studied their lecture notes and assigned readings prior to the posttest.

4. Subjects

The subjects included 88 students enrolled in foodservice management information systems courses during the 1987~1988 school year at Iowa State University. Students in Fall 1987 were assigned to the lecture group(N=46) and those in Spring 1988 were assigned to the self-instructional group(N=42).

When background characteristics of students were compared between the two experimental treatment groups using either chi-square or t-test, no significant differences were found(Table 1). In both groups, one-third of the students were males and two-third were females. Seniors were reported as the most common academic class(80%), while juniors were second. Over 70% were hotel and restaurant majors and approximately 19% were dietetic majors. Students essentially had no work experience related to the inventory control content area.

Students in both groups had identical mean grade point averages of 2.70 on a 4-point scale. The lecture group had a mean age of 21.34 and the self-instruction group had a mean of 21.98. It is apparent that both experimental group were almost identical on what were considered relevant background variables.

5. Data Analysis

Correlation coefficients were computed between pretest, major, and GPA and posttest scores for both experimental groups and across the total samples. The three correlation coefficients between major and posttest for the total group, lecture and self-instruction group were not significant indicating that major was not associated with final achievement. Not surprisingly,

Table 1. Profile of experimental groups

characteristic	lecture(no.=46)		self-instruction(no.=42)	
	no.	%	no.	%
sex				
male	16	34.8	14	33.3
female	30	65.2	28	66.7
grade				
junior	6	13.0	7	16.7
senior	37	80.4	34	81.0
graduate	3	6.6	1	2.3
majors				
hotel and restaurant management	33	71.7	32	76.2
foodservice management	1	2.2	1	2.4
hotel, restaurant, and institution management	2	4.3	1	2.4
dietetics	9	19.6	8	19.0
business administration	1	2.2	-	-
part-time work experience				
storeroom clerk				
no	44	95.7	38	90.5
yes	2	4.3	4	9.5
receiving clerk				
no	42	91.3	38	90.5
yes	4	8.7	4	9.5
full-time work experience				
storeroom server				
no	45	97.8	42	100.0
yes	1	2.2	0	0.0
receiving clerk				
no	45	97.8	42	100.0
yes	1	2.2	0	0.0
supervisor				
no	41	89.1	39	92.9
yes	5	10.9	3	7.1
assistant manager				
no	42	91.3	39	92.9
yes	4	8.7	3	7.1
manager				
no	44	95.7	40	95.2
yes	2	4.3	2	4.8

the correlation coefficients between GPA and posttest scores were significant and were lecture, 0.51; self-instruction, 0.44; and total group, 0.45. These results demonstrated that students with high GPAs scored higher on posttest than did those with lower GPAs.

The coefficients between pretest and posttest score were lecture, 0.55; self-instruction, 0.49, and total group, 0.59. Because the size of the coefficients indicated a relationship between pre- and posttest scores, an analysis of covariance was judged to be the appropriate analysis.

An analysis of covariance was calculated to deter-

mine whether there was a significant difference in the posttest adjusted mean scores between the two experimental treatments. The analysis of covariance also was used to statistically control most of the effect that pretest performance might have had on the posttest mean scores.

Difficulty indices by item by instructional strategy, i. e., lecture versus self-instruction, were calculated. Difficulty differences were plotted and summarized. Plots were studied to determine if some content areas were easier than others by instructional method.

Individual item means and the overall mean were calculated for the attitude inventory. Results were inspected to determine what students liked or disliked about the self-instructional module.

Ⅲ. RESULTS AND DISCUSSION

1. Achievement test

Pretest scores were significantly different by group ($F=49.86$, $p < 0.001$) as determined by the analysis of covariance. The mean pretest score was 26.76 for the lecture group and 30.57 for the self-instructional group (Table 2). Because these initial differences existed between groups, the effect of most these differences in prior knowledge was removed through the use of analysis of covariance and the calculation of adjusted mean scores.

The adjusted mean scores on the achievement posttest between the lecture and self-instructional groups were significantly different($F=6.22$, $p < 0.05$) (Table 2). For the instructional effect, the lecture group had a posttest adjusted mean score of 37.7; the self-instructional group had a score of 40.2, The lecture group had an unadjusted posttest mean score of 36.7 while the self-instructional group had a score of 41.2. The difference of posttest unadjusted mean score between the two experimental groups was 4.51 while the difference of posttest adjusted mean score between the two experimental groups was 2.48(Table 3). Therefore, groups were more similar on posttest adjusted mean score after analysis of covariance than before.

A reduction occurred in the numeric size of the difference between the pretest and posttest mean scores after adjustment. This numeric reduction suggests that the self-instructional module is at least as good as the lecture method. Although the self-instructional module may be better than the lecture method, sufficient degrees of freedom were not available in the quasi-experiment for a more precise testing of the hypothesis.

Table 2. Analysis of covariance between experimental treatments

source of variance	df	sum of squares	mean squares	f-ratio
covariate	1	940.47	940.47	49.86***
treatments	1	117.30	117.30	6.22*
residual	85	1603.31	18.86	

*** $p < 0.001$

* $p < 0.05$

Table 3. Pretest and posttest statistics for achievement test scores

group	pretest		posttest		adjusted posttest mean
	mean	sd[a]	mean	sd[a]	
lecture(n=46)	26.76	5.12	36.70	5.39	37.67
self-instruction(n=42)	30.57	4.80	41.21	4.70	40.15

[a]sd= standard deviation

Difficulty differences between instructional strategy by item and content areas are plotted in Figure 1 and shown in Table 4, If the difficulty index difference was 〉 5% between the two experimental treatments, then one experimental treatment was judged more effective than the other. If the difficulty index

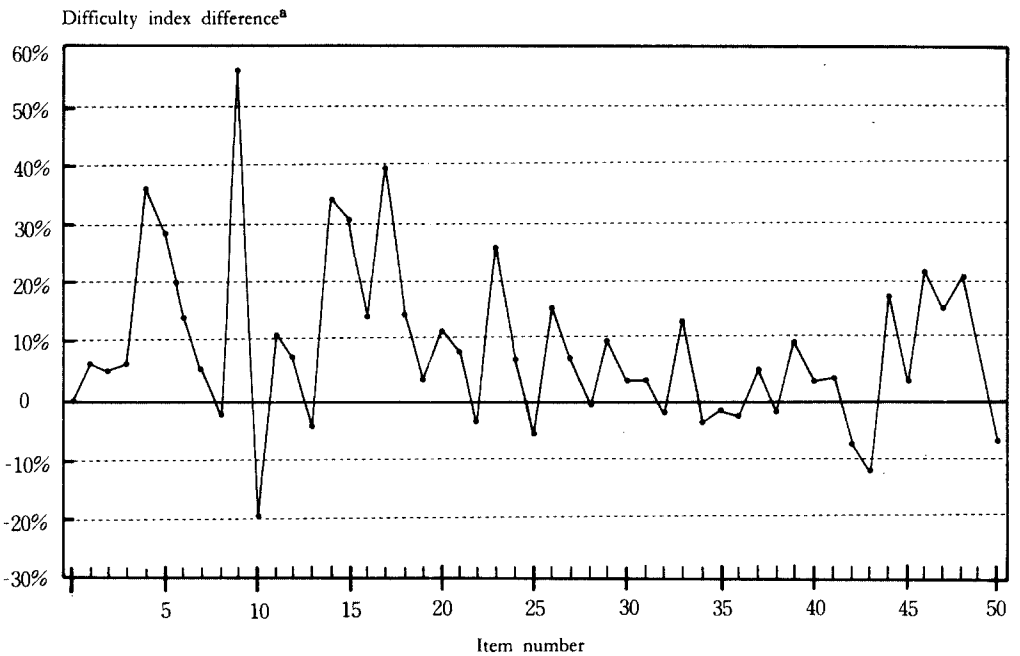
Table 4. Difficulty index difference by content areas and experimental groups

number of items	content area	self-instruction more effective than lecture[a]	lecture more effective than self-instruction[b]	two groups are equal[c]
		no.	no.	no.
6	receiving	4	0	2
6	storing	4	1	1
3	issuing	2	0	1
23	inventory control	11	1	11
8	inventory valuation	3	2	3
4	inventory control computer system	3	1	0

[a] Self-instruction was judged more effective than lecture if the difficulty index differences were 〉 5%.

[b] Lecture was judged more effective than self-instruction if the diffeculty index differences were 〈 -5%

[c] The difficulty index differences were between -5% and +5% between the two experimental groups.



[a] Points plotted above 5% suggest that the items were easier for students who were instructed by the self-instructional module than by the lecture method; points plotted below -5% suggest the items were easier for those instructed by the lecture method.

Figure 1. Difficulty index difference by experimental group

difference range was from -5% to +5% between the two experimental treatments, then the two experimental treatments were judged equal. These values were arbitrarily set by the investigators.

Inspection of Table 4 shows that the self-instruction treatment had more items that were easier after instruction than did the lecture method. Content areas that were easier were: receiving, storing, issuing, and inventory control computer systems. Perhaps a reason for students finding items easier after studying the self-instructional module than exposure to the lecture method was the colse and hands-on experience associated with the self-instructional method.

2. Attitude inventory

Nine of the 17 attitude items had mean scores 〉 6 with a minimum 6.10 and maximum 6.98. Inspection of the mean scores of these nine items indicated that students had a positive feelings toward the self-instruction as a method of learning, felt they learned about inventory control techniques through use of the module, and believed the frames that contained questions reinforced their learning. Collectively, the findings suggested that the students had positive attitudes toward the self-instructional module, as indicated by the mean attitude scale score of 6.15 out of a possible 9 points(Table 5).

Table 5. Attitude scale scores by item for the self-instruction group

item	mean	sd[a]
The module did not meet the hopes that I had or it.	6.98[b]	1.04
It was a waste of time to study this module.	6.95[b]	1.07
The module helped me to learn about the inventory control system.	6.76	1.02
When I hear the word self-instruction, I have a feeling of dislike	6.54[b]	1.57
The module helped me to apply the inventory control system to the foodservice operation or healthcare foodservice systems.	6.51	1.25
The questions in the module were so simple that they were boring	6.46[b]	1.69
I would like more opportunity to use this type of self-instruction in other areas.	6.37	1.58
The questions in the module helped me to grasp the content.	6.34	1.83
I retained the knowledge of inventory control system because of the self-instructional teaching method.	6.10	1.55
The content of the self-instructional module was dull.	5.98[b]	1.74
The questions in the module were an incentive to complete the module.	5.90	1.61
I found the content of the module interesting.	5.88	1.76
Every expectation I had for this module has been exceeded.	5.81	1.38
I wish I was not in the group to use the self-instructional module.	5.71[b]	1.59
I need to study the self-instructional inventory control system module more thoroughly.	5.56	1.72
The content of the module gave me an understanding of inventory control systems.	5.46	1.87
My feelings about the self-instructional module are positive.	5.22	1.78
total	6.15	0.97

[a] sd=standard deviation

[b] Response pattern was reversed because the items described nondesirable characteristics of the self-instructional module.

3. Conclusions and recommendations

The results of experiment showed that self-instructional module was as effective or better than the lecture method in enhancing students' understanding of the inventory control concepts when implemented in the college classroom. Both individual attitude items and the overall attitude scale score showed favorable attitudes by students toward the self-instructional module.

Because the experiment was implemented in a college setting using only two classrooms, it would be desirable to replicate the experiment in the college setting using at least 4 to 6 more classrooms. If it were possible to randomly assign student to classrooms then a study could be conducted using a true-experimental design, *i.* e., a pre- and posttest design with control group.

Finally, the module also might be assessed in a field experiment using dietitians and foodservice and hospitality managers. Such a study would be appropriate because of the similarity of inventory control practices among the three types of managers. If the field experiment were to be implemented, one experimental treatment would be the study of the self-instructional module by practitioners in conjunction with a full-time job; the other experimental treatment could be studying inventory control in a continuing education setting. Such a study would verify the usability of the self-instructional module by practitioners in a field setting.

[References]

1) Hoover, L. W.(1983), Enhancing managerial effectiveness in dietetics. J Am Diet Assoc 82(1), 58～61.

2) Finley, D. H., Kim, I. Y.(1986), Use of selected management science techiques in health care foodservice systems. J Foodserv Sys 4(1), 1～16.

3) Loyd, M. S., and Vaden, A. G.(1977), Practitioners identify competencies for entry-level generalist dietitians. J Am Diet Assoc 71(5), 510～517.

4) Mariampolski, A., Spears, M. C., and Vaden, A. G. (1980), What the restaurant manager needs to know: The consensus. Cornell Hotel & Rest Adm Q 21(3), 77～81.

5) Buergermeister, J.(1983), Assessment of the educational skills and competencies needed by beginning hospitality managers. Hosp Educ Res J 8(1), 38～42.

6) Tersine, R. J.(1982), Principles of Inventory and Materials Management, 2nd ed., New York: North Holland, Inc.

7) Jacobs, P. I., Maier, M. H., and Stolurow, L. M. (1966), A Guide to Evaluating Self-instructional Programs. New York: Holt, Rinehart, and Winston, Inc.

8) Kiang, Min-Hsien Y.(1970), Programmed instruction in nutrition for collegiate nursing students. J Am Diet Assoc 57(5), 423～427.

9) Wittkopt, B.(1972), Self-instruction for student learning. Am J Nurs 72(11), 2032～2039.

10) Fiel, N. J., and Ways, P. O.(1972), Development and evaluation of self-instructional materials. J Med Educ 47(10), 822～824.

11) Shannon, B.(1976), A self-instruction/lecture approach to nutrition for non-majors. J Nutr Educ 8 (3), 107～110.

12) Hughes, D. C., and Reid, N. A.(1975), Programmed learning and conventional teaching. Educ Res 18 (1), 54～61.

13) Holli, B. B. (1982), Continuing professional learning: Involvement and opinions of dietitians. J Am Diet assoc 81(1), 53～57.

14) Hutton, C. W., and Davidson, S. H.(1979), Self-instructional learning packages as a teaching/learning tool in dietetic education. J Am Diet Assoc 75(6), 678～681.

15) Roach, F. R., and Wakefild, L.(1974), Evaluating

a self-instructional module in quantity food purchasing. J Am Diet Assoc 65(2), 166～169.

16) Pietrzyk, B. J., Brittin, H. C., and Chamberlain, V. M.(1978), Programmed instruction in institution purchasing for dietetic students. J Am Diet Assoc 73(5), 520～524.

17) Kim, I. Y., Finley, D. H., and Fanslow, A. M. (1989), Inventory Control System Self-instructional Module. Ames, IA: Iowa State University Press.

18) Dittmer, P. R., and Griffin, C. G.(1984), Principles of Food, Beverage and Labor Cost Control for Hotels and Restaurants. 3rd ed. New York: Van Nostrand Reinhold, Inc.

19) Spears, M. C., and Vaden, A. G. (1985), Foodservice Organizations. New York: John Wiley and Sons, Inc.

20) Powers, T. F., and Powers, J. M.(1984), Foodservice Operations: Planning and Control. New York: John Wiley and Sons, Inc.

21) Stefanelli, J. M.(1985), Purchasing, Selection and Procurement for the Hospitality Industry. 2nd ed. New York: John Wiley and Sons, Inc.

22) West, B. B., Wood, L., Harger, V. F., and Shugart, G. S.(1977), Food Service in Institutions. 5th ed. New York: John Wiley and Sons, Inc.

23) Peddersen, R. B.(1981), Foodsevice and Hotel Purchasing. Boston, MA: CBI Publishing Co., Inc.

24) Knight, J. B., and Kotschevar, L. H.(1979), Quantity Food Production, Planning, and Management. New York: Van Nostrand Reinhold, Inc.

25) Kasavana, M. L.(1984), Computer Systems for Foodservice Operations. New York: Van Nostrand Reinhold, Inc.

26) Chamberlain, V. M., and Kelly, J.(1975), Creative Home Economics Institution. New York: McGraw-Hill Book Co.

27) Yang, I. S., Fanslow, A. M., and Finley, D. H.(1991), Inventory control system achievement test for the dietetic and foodservice management students. Manuscript submitted to the J Am Diet Assoc.

28) Nunnally, J. C.(1982), Reliability of Measurement. In H. E. Mitzl(Ed.), Encyclopedia of educational research. 5th ed.(pp. 1589～1601). New York: The Free Press.