THE EFFECT OF DIFFERENT METHODS OF INSTRUCTION IN WORK SIMPLIFICATION PRINCIPLES AMONG HOME MANAGEMENT STUDENTS

by

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INTRODUCTION AND REVIEW OF LITERATURE

Studies by Warren (1936) and Wiegand (1953) on the homemaker's use of time indicated that productive household activities required a substantial portion of the workday schedule. Furthermore, approximately the same amount of time was devoted to household activities in 1952 as in 1936 (Davis, 1956) despite the introduction of automatic washers and driers, dishwashers, garbage disposals, and other so-called "labor saving" equipment. Since many of the homemaker's jobs have not been eliminated, and because labor saving equipment itself does not appear to reduce substantially the amount of time spent in household tasks, Gilbreth et al. (1955, p. 4) suggested that attention needs to be given to improving methods of work.

Frederick (1921) and Gilbreth (1929) found that work simplification methods used in industry applied to household tasks, could conserve time and energy. Work simplification consists of making motion and time studies of the work as it is being done, analyzing the work methods, developing the easiest and most effective way to do the task, and putting these new methods into use. Charting techniques have been developed to record the work motions. These facilitate analysis of past performance and help determine more effective use of motions in order to improve methods of work. Barnes (1940, pp. 36-41) presented a process chart to describe the steps used in doing a task. He also presented an operation chart which is a more detailed study of some particular part of the process. In the operation chart the movements are broken down into the activities of both the right and left hand. Barnes used "Therbligs" to simplify recording of work motions.

Therbligs are symbols or abbreviations developed by the Gilbreths to describe each step in doing a job (Barnes, 1940, pp. 62-66). Education can play a major role in presenting work simplification to the homemaker as a means for increasing her work efficiency (Kyrk, 1953, p. 290). Educational efforts to this effect are being made in Kansas. Homemakers in the state are reached through conferences, workshops, and pamphlets on work simplification by Home Economics Extension. At Kansas State University a specific course on this topic is offered called "Time and Motions in Household Tasks". The home management program also emphasizes work simplification through the lecture and laboratory instruction. This study was made in connection with the home management program to evaluate the effectiveness of different methods of teaching work simplification.

Home management is required of home economics juniors or seniors majoring in teaching, extension, family economics, and commercial food demonstration. The complete program is offered twice each semester and consists of a lecture and a laboratory course each carrying two semester hours of credit toward graduation. The theory and principles of home management are presented in the lecture class. The girls taking the laboratory reside in houses designed for group living experiences and are under the supervision of a faculty resident adviser. Here the students are expected to apply and coordinate skills and techniques in homemaking, and to determine and evaluate standards of work and products as they relate to improved living.

A survey of selected former Kansas State University home management students was conducted by Ezzard (1955) to find out what homemaking practices they were using in their own homes which had been presented in home management program. Ezzard (1955, p. 46) reported that there was a definite lack

of carryover of the work simplification methods and suggested that additional emphasis on work simplification would strengthen the home management program. Because the length of time given to the home management course at Kansas State University is limited to eight or nine weeks, efficient methods of teaching are needed.

Results of work simplification research applied to household tasks form the basis for teaching work simplification. The studies available vary in scope, methods used, and quality of research. Research in work simplification has been reported on such tasks as hand dishwashing (Fitzsimmons, 1945), bedmaking (Muse, 1949), cleaning (Everett and Gross, 1946), food preparation (Leerkamp, 1947), and hand ironing (Proctor Electric Company, 1948). Of these tasks, hand ironing seemed to be the best task to use for studying methods of instruction in work simplification because (1) standardized ironing methods have been developed; (2) the task could be emphasized in the classroom and demonstrated in the laboratory; (3) individual performance could be measured; (4) no special equipment was required and the equipment that was used could be standardized; and (5) hand ironing as a job would be done by each girl at times other than when charted.

Methods of hand ironing developed by Elaine Knowles Weaver at Cornell University and the studies of ironing methods made by the Home Economics Staff of Washington State College were published by the Proctor Electric Company in 1948. The methods presented emphasized reducing motions and improving the effectiveness of the motions used in hand ironing. Coleman (Columbia University, 1952) mastered the methods outlined in the Proctor booklet and endorsed them as being extremely usable.

As an outgrowth of hand ironing studies, Knowles (1946) recommended

certain equipment to facilitate better ironing methods. Knowles advocated the use of an adjustable ironing board, an iron cord holder, and a board twenty inches wide that could be clipped to a standard board to give more space for ironing large pieces.

The general objectives of this study was to evaluate the effectiveness of different methods of instruction in work simplification among home management students. The primary specific objective was to determine the effect of four methods of instruction in work simplification on the number of motions and strokes required for ironing a napkin. The methods of instruction were: (1) lecture; (2) lecture plus demonstration; (3) lecture demonstration and limited practice; and (4) lecture, demonstration, and complete practice. A second specific objective was to investigate whether principles of work simplification presented on the napkin were transferred (in the absence of further instruction) to the ironing of a blouse. A supplementary objective was to determine whether the instructor's recommendations regarding equipment had affected the students' selection of ironing equipment.

METHOD OF PROCEDURE

Selection of Sample

At Kansas State University there are three home management houses, each accommodating six students. At the time of the study only two houses were in operation. Student residence is one-half a semester, so the maximum of twenty-four students were eligible to participate in the study during one semester. The plan for assigning the girls to four different instructional methods was to compile an alphabetical list of the girls and to assign to each a number using a table of random numbers (Snedecor,

1956, pp. 9-14). The numbers were to be ranked and placed into quartiles. The four groups of girls were to be identified as Groups I, II, III, and IV.

Only eighteen girls were enrolled in the home management laboratory during the fall semester of 1958; ten girls the first half, and eight girls the second half. The girls were assigned random numbers and ranked, but the division into the four groups was complicated by the unequal number of girls enrolled the first half semester. It was determined by chance that Groups I and III would each contain two students with three students assigned to Groups II and IV. The eight students enrolled the second half of the fall semester were equally divided; two students received each method of instruction.

Methods of Instruction

The four groups were assigned the following methods of instruction: Group I, lecture only; Group II, lecture and a demonstration on the Proctor method of ironing a napkin; Group III, lecture, demonstration, and one supervised practice on one napkin; Group IV, lecture, demonstration, and a supervised practice on a number of napkins until the technique used was equivalent to that shown in the demonstration. Since each group of students had only one type of instruction, Groups I, II, III, and IV identify both the student group and the method of instruction.

Lecture

At the time of this study the director of the home management program taught the lecture course. To maintain a normal teaching situation she gave a lecture during a regular class period on the theory and principles of work

simplification as applied to hand ironing. The following principles relating specifically to hand ironing, were presented: use long continuous strokes instead of many short strokes; use both hands whenever possible; iron reverse sides when folding; fold and shift the cloth as few times as possible. A board twenty inches wide designed to clip on an adjustable ironing board, the aluminum ironing board cover, and the iron cord holder were recommended for use. Correct sprinkling procedures, arrangement of the ironing center with a right to left movement sequence, proper working height, the value of sitting while ironing, and pleasant working conditions were stressed in the lecture.

Demonstration

A demonstration was given in the home management laboratory by the laboratory superviser on the Proctor method of ironing a napkin. This method is described and illustrated in Appendix A. The demonstration illustrated the points emphasized in the lecture.

Supervised Practice

After the demonstration the girls in Group III were supervised by the laboratory instructor while they practiced the demonstrated technique on one napkin. The girls in Group IV were supervised while they ironed as many napkins as necessary to iron the napkin with no more motions than the number used in the demonstration.

None of the girls received any instruction on the blouse.

Controls

Napkins and Blouses. The napkins and the blouses used in the study

were of white cotton broadcloth. The material was sanforized, but had no permanent finish. The napkins were eighteen inches square and were machine hemmed. The blouses were size thirty-six, plain, tailored, and sleeveless, and had no trimmings, darts, or tucks.

Ironing Situation. The degree of dampness for the napkins and blouses was controlled by putting them through the rinse cycle of an automatic washer and spinning until damp dry. They were kept for no more than thirty minutes in a closed plastic bag.

In all ironing situations the napkins were placed in the center of the ironing board with the wrong side visible. The napkin was adjacent to the edge of the ironing board in front of the operator. The blouse was placed in the center of the ironing board with the right side of the collar up and toward the operator.

Equipment. The following equipment was used in the study: a steam-dry iron with the temperature dial set on "cotton", a standard ironing board thirty-four inches high and fifteen inches wide, a cotton ironing board pad and cover, an aluminum ironing board cover, an iron cord holder, an ironing board adjustable in height, a twenty inch wide padded three-ply board that clipped on the standard ironing board, and a posture stool for sitting to iron. The following equipment was used in the ironing demonstration: the wide board clipped to the adjustable ironing board, the iron, the iron cord holder and the posture stool.

Operation Chart

An operation chart adapted from Barnes was used to record the motions of the persons ironing. An example of the operation chart is included in Appendix B. Two observers recorded the motions; one recorded

the right hand motions, and the other recorded the left hand motions. Therbligs and also some original abbreviations were used to simplify recording. The Therbligs and abbreviations with their explanations appear in Appendix C. The charting techniques were standardized with observations of girls taking the home management laboratory at Kansas State University during the 1958 summer session.

The recording began after the item had been placed on the ironing board and the operator was ready to pick up the iron for the first time. Charting ended when the operator stopped ironing and the iron had been set in its place for the last time.

Charting Procedures

During the first week of home management residence, before any instruction had been given, the girls were charted on both the napkin and the blouse. These observations are referred to as the "before" data. All of the equipment listed was made available to the girls, and each was to use that which she preferred.

Immediately after the prescribed instruction for the group, each girl was charted while ironing one napkin. The girls in Group I, whose instruction terminated with the lecture, were again allowed to choose the equipment each preferred. Groups II, III, and IV were charted using the demonstration equipment. This charting is designated as "intermediate".

After approximately five weeks had elapsed since their prescribed instruction, each of the girls was charted again while ironing one napkin and one blouse. These observations are called the "after" data. At this time each girl was encouraged to choose that equipment she had become accustomed to using even though the equipment she selected might not have

been recommended in the lecture or demonstration.

Analysis of Data

The operation charts were summarized with respect to the total number of strokes and total number of motions. "Strokes" referred to the actual ironing strokes with the iron, and "total motions" included motions such as shifting, folding, and strokes made while ironing the blouses and napkins. The data were tabulated and classified by individual girls (coded: 1 to 5), by each half semester (coded: a and b), by types of instruction (coded: groups I, II, III, and IV), and by the time of charting (coded: before, intermediate, and after). A copy of the summary sheet is included in Appendix D.

The differences in the number of strokes and total motions used by each girl were calculated from observations made (1) "before" and "after", (2) "before" and "intermediate", and (3) "intermediate" and "after" on the napkin. These calculations were then converted to per cent reduction using the earlier time of charting as the base. The data for each group, both first and second half were pooled, and an analysis of variance (Snedecor, p. 268) was conducted on the per cent reduction to determine whether the differences among the four methods of instruction were statistically significant. Where a significant difference was found, the LSD, least significant difference, (Snedecor, p. 251), was used to discover the most effective method of instruction. Where there was an apparent improvement, but methods were not sufficiently different, the sign test (Snedecor, p. 114) was used to determine if the change in performances was significant irrespective of method of instruction.

The same calculations and tests were made from observations "before"

and "after" on the blouse.

The ironing equipment used by each girl in the three chartings was summarized for analysis, but the data were not treated statistically.

RESULTS AND DISCUSSION

Napkins

Each of the girls enrolled in home management laboratory in the fall semester of 1958 was charted while she ironed a napkin as one part of this study. Charting was done before instruction was given on work simplification principles as applied to hand ironing, immediately following instruction. The following tables show (1) the total number of motions and strokes used by each girl while ironing the napkins, (2) the per cent reduction in motions and strokes between specified chartings, and (3) the statistical analysis used to evaluate the effectiveness of the different methods of instruction.

Total Motions. The total number of motions used by each girl during the periods "before", "intermediate" and "after" is shown in Table 1. The students were grouped by the method of instruction each received and shown as: I, lecture; II, lecture plus demonstration on the Proctor method of ironing a napkin; III, lecture, demonstration and one supervised practice on one napkin; and IV, lecture, demonstration, and supervised practice on a number of napkins until the number of motions used was equivalent to the number demonstrated. Students enrolled for the first half of the semester are designated by the letter "a", and those enrolled the second half, by the letter "b". The average (mean) number of motions for each group by the time of charting is shown.

The individual differences among students are evident in the varying number of motions used in the "before" charting. Differences were also found in the acceptability of the finished product. The student who used the least motions "before", (1a, III) performed haphazardly and produced a product which was not considered acceptable by the observers. At the time of the final charting, she had further reduced the number of motions and in the opinion of the observers had improved the quality of her motions so that the final product was acceptable. By contrast, the student using the most motions (1a, IV), was quite meticulous in her ironing, and the final product was considered acceptable by the observers. Her final product in the "after" instruction period was also satisfactory and she had decreased the motions from 193 to 58, a 70% decrease in total number of motions. Attitudes toward ironing as a job and toward the introduction of new methods of ironing also varied among students. For example, the poor attitude of Student 1a, III, was expressed in her finished product and her ironing habits in the "before" charting, but she showed an improvement in her attitude toward the job along with improvement in quality of motions used and in her finished product in the "after" charting. A poor attitude prevailed in the case of Student 1a, I and poor ironing habits were retained. Other factors peculiar to this study may have affected individual performance. Since the charting was done in the laboratory in the presence of the adviser, the situation had a classroom atmosphere. The students were concerned with grades although they were told that their laboratory grade would not be affected by this particular activity. Still, the desire to please the instructor undoubtedly affected performance. The performance of certain girls may have been affected by the fact that ironing under close surveillance made them nervous. However, irrespective of these factors,

there is a reduction in the number of motions for every student regardless of the method of instruction received.

Table 1. Total number of motions used in ironing the napkins.

Method of Instruction	Student Number	Time of Charting		
		Before	Intermediate	After
I	1a	129	118	109
	2a	140	103	111
	3a	-	-	-
	4b	83	60	50
	5b	107	69	59
	Mean	114.75	87.50	82.25
II	1a	126	48	74
	2a	133	66	78
	3a	148	66	64
	4b	106	37	39
	5b	89	53	49
	Mean	120.40	54.00	60.80
III	1a	71	35	45
	2a	137	48	58
	3a	-	-	-
	4b	97	44	44
	5b	173	31	36
	Mean	119.50	39.50	45.75
IV	1a	193	50	58
	2a	98	34	43
	3a	141	47	35
	4b	133	33	34
	5b	95	49	49
	Mean	132.00	42.60	43.80

The per cent reduction in the total number of motions used by each girl from "before" to "intermediate" observations is shown in Table 2. The average (mean) per cent reduction is greater as the intensity of the instruction is increased.

Table 2. Per cent reduction in the total number of motions used in ironing the napkin from "before" to "intermediate" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	8.53	61.90	50.70	74.09
2a	26.43	50.38	64.96	65.31
3a	-	55.41	-	66.67
4b	27.71	65.09	54.64	75.19
5b	35.51	40.45	82.08	48.42
Mean	24.54	54.65	63.10	65.94
	$LSD_{4,4} = 17.30$	$LSD_{4,5} = 16.41$	$LSD_{5,5} = 15.47$	

LSD - Least Significant Difference.

The analysis of variance was conducted on the per cent reduction from "before" to "intermediate" observations (Table 3). The difference among the methods of instruction was significant at the .001 level. The LSD was used to compare the mean of Method I with the mean of Method II, and the difference was found to be significant. The mean of Method I was also significantly different from that of Methods III and IV. However, the differences between the means of Methods II, III, and IV were not significant.

Table 3. Analysis of variance of the per cent reduction in the total number of motions used in ironing the napkin from "before" to "intermediate" chartings.

Source	df	Ss	Ms	F
Method	3	4,496.62	1,498.87	11.52***
Students	14	1,821.18	130.08	

*** Significant at the .001 level.

The per cent reduction from "intermediate" to "after" in the total number of motions used in ironing the napkin is shown in Table 4. Ten of the eighteen students showed an increase in the number of motions used, as designated by the minus signs, while only six students continued to decrease motions from the "intermediate" to "after" charting. Two students exhibited no change.

Table 4. Per cent reduction in the total number of motions used in ironing the napkin from "intermediate" to "after" chartings.

Student Number	Method of Instruction			
	I	II	III	IV
1a	7.63	-54.16	-28.57	-16.00
2a	-7.77	-18.18	-20.83	-26.47
3a	-	3.03	-	25.53
4b	16.67	-5.41	0.00	-3.03
5b	14.49	7.55	-16.13	0.00
Mean	7.75	-13.44	-16.38	-3.99

Note: Minus sign indicates per cent increase.

The analysis of variance was conducted on the data summarized in Table 4. No significant difference among the methods of instruction was found at the .05 level (Table 5).

The per cent reduction in total motions from "before" to "after" observations, shown in Table 1, was calculated for each girl and presented in Table 6. Also calculated and presented is the average (mean) decrease for each group. All students showed a decrease in total motions, and the average per cent reduction for each group increased with the increased intensity of instruction.

Table 5. Analysis of variance of the per cent reduction in the total number of motions used in ironing the napkin from "intermediate" to "after" chartings.

Source	df	Ss	Ms	F
Method	3	1,474.21	491.40	1.43 n.s.
Students	14	4,798.23	342.73	

Table 6. Per cent reduction in the total number of motions used in ironing the napkin from "before" to "after" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	15.50	41.27	36.62	69.95
2a	20.71	41.35	57.66	56.12
3a	-	44.94	79.19	48.42
4b	39.76	56.76	-	75.18
5b	44.86	63.21	54.64	74.44
Mean	30.21	49.51	57.03	64.82

$LSD_{4,4} = 20.24$ $LSD_{4,5} = 19.20$ $LSD_{5,5} = 18.10$

LSD - Least Significant Difference.

The analysis of variance was conducted on the per cent reduction in the total number of motions from "before" to "after chartings (Table 7). The difference among the methods of instruction was significant at the .05 level.

Table 7. Analysis of variance of the per cent reduction in the total number of motions used in ironing the napkin from "before" to "after" chartings.

Source	df	Ss	Ms	F
Method	3	2,840.66	946.89	5.32*
Students	14	2,492.66	178.05	

* Significant at the .05 level

The LSD was used to compare the mean of Method I with the mean of Method II, and the difference was found to be significant. The mean of Method I was also significantly different from that of Methods III and IV. However, the differences between the means of Methods II, III, and IV were not significant.

Strokes. The total number of actual ironing strokes used by each girl in ironing the napkin at each of the three chartings is shown in Table 8. The "before" mean for each group shows the average number of strokes used before instruction was given; the "intermediate" and "after" means show the average number of strokes used after the designated instructional method had been given. The average number of strokes used was less after all methods of instruction. Again, as in Table 1, individual differences can be noted in the varying number of strokes used in the "before" charting.

Student 1a, III, used the fewest strokes in the "before" charting

and Student 1a, IV, used the most strokes. All students demonstrated a need for improving the quality of the strokes used. Representative of poor ironing habits were short jerky strokes, ironing one spot many times, and using pressure with the ironing stroke. The average decrease made in the number of strokes used was greater among those who had more instruction than lecture alone (Method I).

Table 8. Total number of strokes used in ironing the napkin.

Method of Instruction	Student Number	Time of Charting		
		Before	Intermediate	After
I	1a	81	76	50
	2a	52	60	60
	3a	-	-	-
	4b	30	15	14
	5b	63	44	27
	Mean	56.50	48.75	37.75
II	1a	67	19	37
	2a	60	22	25
	3a	79	20	19
	4b	45	14	11
	5b	58	21	15
	Mean	61.80	19.20	21.40
III	1a	24	16	19
	2a	64	18	19
	3a	-	-	-
	4b	34	16	14
	5b	115	10	12
	Mean	59.25	15.00	16.00
IV	1a	100	14	18
	2a	49	14	11
	3a	80	14	13
	4b	72	14	13
	5b	55	15	17
	Mean	71.20	14.20	14.40

The per cent reduction in the total number of strokes used by each girl in ironing the napkin from "before" to "intermediate" is shown in Table 9. All students showed a decrease in the number of strokes used while one student (2a, I) increased the number of strokes used by 15.38% as shown by the minus sign.

Table 9. Per cent reduction in the total number of strokes used in ironing the napkin from "before" to "intermediate" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	6.17	71.64	33.33	86.00
2a	-15.38	63.33	71.88	71.43
3a	-	74.68	-	82.50
4b	50.00	68.89	52.94	80.56
5b	30.16	63.79	91.30	72.73
Mean	17.74	68.47	62.36	78.64
	$LSD_{4,4} = 27.32$	$LSD_{4,5} = 25.92$	$LSD_{5,5} = 24.44$	

LSD - Least Significant Difference.

Note: Minus sign indicates per cent increase.

The analysis of variance conducted on the per cent reduction in total number of strokes from "before" to "intermediate" showed that the difference among methods of instruction was significant at the .01 level (Table 10).

Table 10. Analysis of variance of the per cent reduction in the total number of strokes used in ironing the napkin from "before" to "intermediate" chartings.

Source	df	Ss	Ms	F
Method	3	9,231.03	3,077.01	9.48**
Students	14	4,542.17	324.44	

** - Significant at the .01 level.

The LSD was used to compare the mean of Method I with the mean of Method II and the difference was significant. The mean of Method I was also significantly different from the mean of Method III and Method IV. However, the differences between the means of Method II, III, and IV were not significant.

The per cent reduction in the total number of strokes used in ironing the napkin from "intermediate" to "after" chartings is shown in Table 11. Ten of the students show a decrease in the number of strokes used from the "intermediate" to "after" charting. However, seven of the eighteen students show an increase in the number of strokes used as indicated by the minus signs, and one shows no change.

Table 11. Per cent reduction in the total number of strokes used in ironing the napkin from "intermediate" to "after" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	34.21	-94.74	-18.75	-28.57
2a	00.00	-13.64	-5.56	21.43
3a	-	5.00	-	7.14
4b	6.67	21.43	12.50	7.14
5b	38.64	28.57	-20.00	-13.33
Mean	19.88	-10.68	-7.95	-1.24

Note: Minus sign indicates per cent increase.

The analysis of variance shows no significant difference among methods of instruction in regard to the per cent reduction in the total number of strokes from "intermediate" to "after" chartings (Table 12).

Table 12. Analysis of variance of the per cent reduction in the total number of strokes used in ironing the napkin from "intermediate" to "after" chartings.

Source	df	Ss	Ms	F
Method	3	2,403.56	801.19	.85 n.s.
Students	14	13,252.56	946.61	

The per cent reduction in the total number of strokes used in ironing the napkin from "before" to "after" is shown in Table 13. Seventeen of the eighteen students showed a reduction in the number of strokes used (with the exception of Student 2a, I).

Table 13. Per cent reduction in the total number of strokes used in ironing the napkin from "before" to "after" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	38.27	44.78	20.83	82.00
2a	-15.38	58.33	70.31	77.55
3a	-	75.95	-	83.75
4b	53.33	75.56	58.82	81.94
5b	57.14	74.14	89.57	69.09
Mean	33.34	65.75	59.88	78.87

Note: Minus sign indicates per cent increase.

The analysis of variance (Table 14) on the above data showed no significant difference among methods of instruction; however, the F-value, 3.18, approached significance ($P < .10$). The sign test indicated that after instruction, there was a significant decrease ($P < .01$) in the number of strokes irrespective to the method of instruction.

Table 14. Analysis of variance of the per cent reduction in the total number of strokes used in ironing the napkin from "before" to "after" chartings.

Source	df	Ss	Ms	F
Method	3	4,773.95	1,591.37	3.28 n.s.
Students	14	6,786.18	484.73	

Blouse

Each of the girls was charted while she ironed a blouse as the second part of this study; once before any instruction on work simplification as applied to hand ironing had been given and again after a period of five weeks had passed since the completion of the instruction. The total number of motions and strokes used, the per cent reduction in motions and strokes between the "before" and "after" chartings, and the statistical analyses are presented in the subsequent tables.

Total Motions. The total number of motions used by each girl during the "before" and "after" periods of charting is shown in Table 15. The classroom atmosphere, individual differences, and attitudes (factors listed previously) may have affected the performance of the students. However, there is a decrease in the total number of motions for each student, irrespective of method of instruction.

Table 15. Total number of motions used in ironing the blouse.

Method of Instruction	Student Number	Time of Charting	
		Before	After
I	1a	563	397
	2a	783	394
	3a	-	-
	4b	375	208
	5b	452	255
	Mean	543.25	313.50
II	1a	543	269
	2a	592	287
	3a	455	332
	4b	383	183
	5b	376	188
	Mean	469.80	251.80
III	1a	201	166
	2a	541	157
	3a	-	-
	4b	308	207
	5b	574	355
	Mean	406.00	221.25
IV	1a	624	222
	2a	629	285
	3a	718	244
	4b	484	236
	5b	279	159
	Mean	546.80	229.20

The per cent reduction in the total number of motions used in ironing the blouse from "before" to "after" chartings is shown in Table 16.

The analysis of variance (of the per cent reduction in the total number of motions from "before" to "after") showed no significant difference among the four methods of instruction (Table 17). The sign test indicated that after instruction, there was a significant decrease ($P < .01$) in the number of motions per student, irrespective of the method of instruction.

Strokes. The total number of strokes used by each girl during the "before" and "after" chartings on the blouse are shown in Table 18. The average (mean) number of strokes for each group decreased after instruction as shown by the absolute numbers in Table 18, and by the per cent reduction in the number of strokes after instruction as shown in Table 19.

Table 16. Per cent reduction in the total number of motions used in ironing the blouse from "before" to "after" chartings.

Student Number Within Group	Method of Instruction			
	I	II	III	IV
1a	29.48	50.46	17.41	64.42
2a	49.68	51.52	70.98	54.69
3a	-	27.03	-	66.02
4b	44.53	52.22	32.79	51.24
5b	43.58	50.00	38.15	43.01
Mean	41.82	46.25	39.83	55.88

Table 17. Analysis of variance of the per cent reduction in the total number of motions used in ironing the blouse from "before" to "after" chartings.

Source	df	Ss	Ms	F
Methods	3	705.39	235.13	1.28 n.s.
Students	14	2,578.80	184.20	

Table 18. Total number of strokes used in ironing the blouse.

Method of Instruction	Student Number	Time of Charting	
		Before	After
I	1a	287	195
	2a	414	167
	3a	-	-
	4b	166	68
	5b	213	72
	Mean	270.00	125.50
II	1a	281	73
	2a	284	85
	3a	228	153
	4b	140	67
	5b	185	64
	Mean	223.60	88.40
III	1a	54	44
	2a	312	56
	3a	-	-
	4b	127	66
	5b	336	139
	Mean	207.25	76.25
IV	1a	246	56
	2a	214	86
	3a	407	61
	4b	219	84
	5b	102	45
	Mean	237.60	66.40

Table 19. Per cent reduction in the total number of strokes used in ironing the blouse from "before" to "after" chartings.

Student Number Within Group	Method of Instruction I	II	III	IV
1a	32.06	74.02	18.52	77.24
2a	59.66	70.07	82.05	59.81
3a	-	32.89	-	85.01
4b	59.04	52.14	48.03	61.64
5b	66.20	65.41	58.63	55.88
Mean	54.24	58.91	51.81	67.92

The sign test indicated that after instruction, there was a significant decrease ($P < .01$) in the number of strokes per student, irrespective of the method of instruction, and the quality of strokes used was improved. However, an analysis of variance showed no significant difference among methods of instruction (Table 20).

Table 20. Analysis of variance of the per cent reduction in the total number of strokes used in ironing the blouse from "before" to "after" chartings.

Source	df	Ss	Ms	F
Method	3	694.32	231.43	.72 n.s.
Students	14	4,517.98	322.71	

Ironing Equipment

As the third part of this study, the girls were given an opportunity to choose from the following ironing equipment during the periods of charting: (1) a standard ironing board fifteen inches wide, thirty-four inches high, with a cotton cover; (2) an adjustable ironing board with an aluminum cover; (3) an iron cord holder; (4) a stool for sitting while ironing; and (5) a board twenty inches wide that could be clipped to the adjustable ironing board.

Standard Ironing Board. As shown in Table 21, all students used the standard ironing board during the period of charting before instruction. In the chartings after instruction, none of the students continued to use the standard ironing board.

Adjustable and Wide Ironing Board. None of the students chose the adjustable or the wide ironing boards when they were charted before recommendations were made concerning ironing equipment. However, when charted immediately after instruction during which the use of the adjustable and wide boards was recommended, fifteen students experimented with the wide board and three used the adjustable ironing board. In the "after" period of charting, nine of the students who had used the wide ironing board in the "intermediate" charting preferred the adjustable ironing board because they "were not accustomed to ironing on the wide board". Two of the students who had previously used the wide board continued to use this piece of equipment in the "after" charting; four students used the wide board when ironing the napkin, and changed to the adjustable ironing board to iron the blouse. The three students using the adjustable ironing board in the "intermediate" period of charting continued to use

Table 21. Ironing equipment employed by each student in the "before", "intermediate" and "after" periods of charting.

Method of Instruction	Student Number	Time of Charting		
		Before	Intermediate	After
I	1a	1	2, 3	2, 3
	2a	1	2, 3	2, 3
	3a	-	-	-
	4b	1	2, 3	2, 3
	5b	1	3, 5	2, 3
II	1a	1	3, 4, 5	2, 3
	2a	1	3, 4, 5	2, 3
	3a	1	3, 4, 5	2, 3
	4b	1	3, 4, 5	2, 3
	5b	1	3, 4, 5	3, 5*
III	1a	1	3, 4, 5	3, 4, 5
	2a	1	3, 5	2, 3
	3a	-	-	-
	4b	1	3, 4, 5	3, 4, 5*
	5b	1	3, 4, 5	3, 4, 5
IV	1a	1	3, 4, 5	2, 3
	2a	1	3, 4, 5	2, 3
	3a	1	3, 4, 5	2, 3
	4b	1	3, 4, 5	3, 5*
	5b	1	3, 4, 5	3, 5*

Note: The ironing equipment is coded by the following numbers: (1) standard ironing board, fifteen inches wide, thirty-four inches high, with a cotton cover; (2) adjustable ironing board with an aluminum cover; (3) an iron cord holder; (4) stool for sitting to iron; and (5) wide board clipped to the adjustable ironing board.

* Changed to the adjustable board for ironing the blouse only.

it during the "after" period of charting.

Stool. None of the students used the stool for sitting to iron when they were charted before any instruction. Only three of the thirteen students who used the stool for sitting to iron when they were charted immediately after the value of sitting to iron had been discussed, continued to use this piece of equipment in the "after" period of charting. Those girls who did not continue to sit to iron commented that they were not accustomed to this practice and preferred to stand.

Iron Cord Holder. None of the students used the iron cord holder in the "before" period of charting. However, after the use of this piece of equipment was recommended in the instruction, all students used the iron cord holder in the "intermediate" period of charting and continued to use it when they were charted after the five weeks time lapse.

SUMMARY AND CONCLUSIONS

During the fall semester of 1958, eighteen students taking home management laboratory at Kansas State University were charted while they ironed a napkin and a blouse. These students were observed and charted before and at specific times after receiving one of four methods of instruction in work simplification as applied to hand ironing.

The primary objective was to determine which of the four methods of instruction was most effective in reducing the total number of motions and strokes required for ironing a napkin. A second objective was to investigate whether instruction in principles of work simplification applied to ironing a napkin were later transferred by the students to ironing a blouse on which no specific instruction had been given. A supplementary objective was to determine whether the instructor's recommendations

concerning equipment affected the student's selection of ironing equipment.

The results of the study showed that the students who had the lecture only (Method I), experienced the least per cent reduction in the total number of motions and strokes used in ironing the napkin, and that this method was significantly less effective than lecture plus demonstration (Method II), lecture, demonstration, and limited practice (Method III), and lecture, demonstration and complete practice (Method IV). While there was no significant difference among Methods II, III, and IV, Method IV produced the greatest per cent reduction of total number of motions and strokes. Method III was next most effective in the reduction of total motions, but Method II ranked next to Method IV in the per cent reduction in the total number of strokes used in ironing a napkin.

After instruction was given in work simplification principles as applied to the napkin, there was a significant decrease per student in the total number of motions and strokes used in ironing the blouse. There was no significant difference in the effectiveness of the four methods of instruction in per cent reductions of total motions and strokes used in ironing the blouse.

Recommendations made regarding the use of certain ironing equipment were adopted completely by only three of the eighteen students participating in the study. However, each of the remaining fifteen girls continued to use some of the recommended ironing equipment and none reverted to using the ironing equipment (the standard ironing board only) chosen before instruction had been given.

It was concluded that lecture plus demonstration and supervised practices was the most effective method of teaching work simplification, even though there was no significant difference in effectiveness of all methods which used a demonstration. Lecture alone, although significantly less effective than the other methods in the reduction of the number of motions and strokes used to iron a napkin, caused a significant reduction in the number of motions and strokes used to iron the blouse. Therefore, lecture only is considered to be a satisfactory method of presenting work simplification techniques, especially when time is limited for this phase of the home management course.

The use of lecture plus demonstration is recommended and when time permits, the addition of supervised practice periods is desirable.

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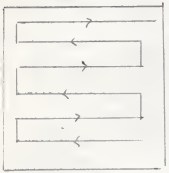
APPENDIX

APPENDIX A

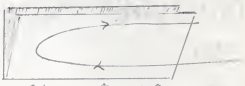
Method of Hand Ironing a Napkin* as Shown in the Laboratory Demonstration

Left Hand Description	Symbol	Symbol	Right Hand Description
1.		G	Grasp iron
2.		TL	Transport loaded
3. Position,6	P,6	I,11	Iron, 11 strokes
4.		TL	Transport loaded
5.		T	Tip iron on end
6.		TE	Transport empty
7. Grasp lower left corner	G	G	Grasp lower right corner
8. Fold to upper left corner	F	F	Fold to upper right corner
9.		TE	Transport empty
10.		G	Grasp iron
11.		TL	Transport loaded
12. Position,1	P,1	I,1c	Iron, 1 circular stroke
13. Fold	F	H	Hold
14. Position,1	P,1	I,1c	Iron, 1 circular stroke
15. Fold	F	H	Hold
16. Position,1	P,1	I,1c	Iron, 1 circular stroke
17.		TL	Transport loaded
18.		T	Tip iron on end

* Adapted from "Ironing Can Be Easy, pp. 10-41, Proctor Electric Company. 1948.



Step 3



Steps 8 and 9

Steps 13 and 14

Steps 15 and 16

APPENDIX B

OPERATION STUDY CHART*

Operator _____ Charting Sequence _____ Time _____

Operation _____ Charted by _____ Page _____

Treatment _____ Hand Charted _____

Description	Symbol	Comments

* Adapted from Ralph M. Barnes, Time and Motion Study, pp. 36-41.

APPENDIX C

Therblig Abbreviations and Definitions[1]

G	Grasp	Closing fingers around object
TE	Transport empty	Moving empty hand in reaching for object
TL	Transport loaded	Object being carried, sliding, or dragging
H	Hold	After object has been grasped, no movement of object taking place. Hold begins when the movement of the object stops and ends with the start of the next Therblig
RL	Release load	Letting go of iron
P	Position	Orient properly
In	Inspect	Examine with eyes
UD	Unavoidable delay	Begins when activity stops and ends when activity is resumed, e.g., failure or interruption in process
AD	Avoidable delay	Just plain stop
Pn	Plan	Decide
F*	Fold	Fold napkins
I*	Iron	Number of strokes
T*	Tip	Tip iron up on end
Sh*	Shift	Shift position of item
Sm*	Smooth	Smooth out wrinkles

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[1] Gilbreth et al. Management in the Home, pp. 90-95.

* Developed for specific use in this study.

APPENDIX D

SUMMARY SHEET

Operation: Hand Ironing Napkins Operator _____ Method of Instruction _____

Number of Motions	Time of Charting		
	Before	Intermediate	After
right hand			
left hand			
total			
Strokes of the iron			
Equipment			

Operation: Hand Ironing Blouse

Number of Motions	Time of Charting	
	Before	After
right hand		
left hand		
total		
Strokes of the iron		
Equipment		

THE EFFECT OF DIFFERENT METHODS OF INSTRUCTION IN WORK SIMPLIFICATION PRINCIPLES AMONG HOME MANAGEMENT STUDENTS

by

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B. S., Kansas State College
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The purpose of this research was to determine which of four methods of instruction was most effective in presenting work simplification principles to home management students. The primary objective was to determine which method of instruction in work simplification principles applied to hand ironing was most effective as measured by the per cent reduction in the number of motions and strokes used to iron a napkin.

A second objective was to investigate whether principles of work simplification applied to hand ironing were transferred by the students to the ironing of a blouse on which no specific instruction had been given. A supplementary objective was to determine whether the instructor's recommendation concerning equipment affected the student's selection of ironing equipment.

Eighteen students taking the home management laboratory during the fall semester of 1958 were divided into four groups, each of which received different types and or different amounts of instruction in work simplification principles applied to hand ironing.

The methods of instruction were: I, lecture; II, lecture and a demonstration; III, lecture, demonstration, and a supervised practice; and IV, lecture, demonstration, and supervised practices until a standard was attained. A napkin was used as the example when discussing or explaining principles.

Before any instruction was given, each student was charted while ironing one napkin and one blouse. The various teaching techniques were then applied and a charting was done immediately on the napkin to determine the effect of each method of instruction. Five weeks after the instruction had been given a third charting was done while each student

ironed a napkin and a blouse to determine the retention and carry-over of principles of work simplification as presented in the different methods of instruction.

The results of the study showed that the students who received the lecture only (Method I) experienced the least per cent reduction in the number of motions and strokes used in ironing the napkin. Method I was significantly less effective than lecture and a demonstration (Method II), lecture, demonstration and a supervised practice (Method III), and lecture, demonstration, and supervised practices until a standard was attained (Method IV). There was no significant difference in the effectiveness of Methods II, III, and IV. However, the students receiving Method IV instruction exhibited the greatest per cent reduction in the number of motions and strokes used in ironing the napkin. Method III ranked next in per cent reduction of the number of motions used, while Method II was more effective than Method III in the per cent reduction of strokes used in ironing the napkin.

In investigating the carry-over of work simplification principles to ironing the blouse, it was found that there was a significant decrease in the number of motions and strokes used. However, there was no significant difference in the efficiency of the teaching methods.

Recommendations made regarding the use of certain ironing equipment were adopted completely by only three of the eighteen students participating in the study. However, each of the remaining fifteen girls continued to use some of the recommended ironing equipment and none reverted to using the ironing equipment (the standard ironing board only) chosen before instruction had been given.