EVALUATION OF INSTRUCTIONAL TECHNIQUES DESCRIBED AS EFFECTIVE BY FLIGHT INSTRUCTORS

by

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with the cooperation of

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A series of projects conducted by the Committee on Selection and Training of Aircraft Pilots under the provisions of a contract between the Civil Aeronautics Administration and the National Research Council.

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Committee on Selection and Training of Aircraft Pilots

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LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue, Washington, D. C.
Division of Anthropology and Psychology

Committee on Selection and Training of Aircraft Pilots

June 29, 1946

Dr. Dean R. Brimhall
Director of Research
Civil Aeronautics Administration
Room 3895, Commerce Building
Washington 25, D. C.

Dear Dr. Brimhall:

Attached is a report entitled Evaluation of Instructional Techniques Described as Effective by Flight Instructors by Edwin S. Ewart, Albert S. Thompson, and Morris S. Viteles, with the cooperation of Dean R. Brimhall. This report is submitted by the Committee on Selection and Training of Aircraft Pilots with the recommendation that it be included in the series of Technical Reports issued by the Division of Research, Civil Aeronautics Administration.

The report is of interest in that it represents an effort to compile and make use of the knowledge and experience of flight instructors in training pilots. The compilation and evaluation of instructional techniques or "tricks" suggested by experienced instructors has the additional merit of providing leads for experimental research in training methods.

Cordially yours,

MSV:rm

Morris S. Viteles, Chairman
Committee on Selection and
Training of Aircraft Pilots
National Research Council

FOREWORD

The investigation described in this report involved a compilation of instructional techniques or "tricks" submitted by 99 pilot instructors on the basis of a questionnaire submitted to approximately 1250 flight instructors throughout the United States. These instructional techniques or "tricks" were then submitted for evaluation by 49 individuals, including instructor training personnel in the AAF and the United States Navy and members of the General Inspection Division, Civil Aeronautics Administration. In the present report the instructor tricks are classified into three groups, viz: "A" - Good and not used by the great majority of flight instructors; "C" - Good but must be used with extreme caution; "E" - Bad and should not be used. The purpose of such classification is to provide a guide as to the general usefulness of these tricks to flight instructors who may be interested in benefiting from the experience and ideas of flight instructors who contributed to the original compilation of instructional techniques.

The classification of tricks into three categories was made without the benefit of rigorous statistical treatment, on the basis of the number of judges rating a trick as "Good and not in general use" and the number rating the same trick as "Bad and should not be used." The decision as to the cut-offs at each end of the scale was made arbitrarily through inspection of the data and is based entirely on the assumption that a trick which is seldom rated as "Bad and should not be used" and is rated with some degree of frequency as "Good and not in general use" represents a technique worthy of consideration by flight instructors.

Consideration has been given to the possibility of using more rigorous statistical techniques as a basis for categorization of the instructional techniques. It is apparent, for example, that correlational techniques could be used to determine the degree of consistency among judges in evaluating the tricks. If judges showed considerable agreement with each other, there would be reason for greater confidence in categorizations such as have been made in this report. Nevertheless, it seemed undesirable to undertake such a correlational analysis because, after the necessary 1156 correlations had been obtained, there would still be considerable difficulty in interpreting the findings if lack of consistency among judges were revealed. Moreover, inspection of the data showed that since on the whole the judges classified relatively few techniques as "Bad and should not be used," the bulk of the tetrachoric coefficients between judges would be based on fourfold tables wherein the number or percentage of cases in one of the dichotomies, on one or both axes, would be considerably smaller than that ordinarily considered necessary for definitive findings.

Assuming that such indices of reliability were obtained, there would still remain the problem of determining statistically the number of "bad," ratings which should be considered as disqualifying a technique from cate-

gorization as a "satisfactory" or acceptable technique, and the minimum number of "good" ratings which should be required for the qualification of a trick as a "satisfactory" or acceptable technique. It is evident, of course, that psychophysical techniques might be employed in the determination of thresholds as a basis for such categorization. In this connection the question may immediately be raised as to whether the threshold value can be defined as meaningfully in interpreting judgments of the type made in this investigation as in the more usual psychophysical studies. Preliminary analysis shows, for example, that if the limen were set at the point at which 50 per cent of the judges rated a technique "bad," 335 of the 341 techniques would be classified as satisfactory and the technique would be categorized as unacceptable only if rated as "Bad and should not be used" by more than 24 judges. Techniques rated "bad" by relatively large proportions of the judges were included in the "satisfactory" group by other definitions of the threshold in psychophysical terms. There is a serious question whether such categorization can be defended on logical grounds or would meet general acceptance in the field, despite the apparent rigorousness of the statistical procedures. Recognising such disadvantages of psychophysical procedures, cut-off points might be established in relation to "chance" distributions of ratings in the various categories. However, after preliminary work, this type of analysis was also discarded as inapplicable in terms of the data and purposes of the present investigation.

For reasons given above, the classification of tricks as presented in this report is not based on rigorous statistical treatment of data. The fact that the classification is based on estimates by multiple judgments gives reason for some degree of confidence in the reliability of the judgments.

The investigation furnishes no internal evidence with respect to the validity of any or all of the instructional techniques. Nevertheless, in as much as all techniques recommended as satisfactory received only three, or fewer, ratings of "bad," there may be justification for the hypothesis that none of the recommended techniques is clearly dangerous or constitutes a physically hazardous method of flight instruction. For this reason, and in view of the frequency of acceptable ratings for techniques included as satisfactory, it appears that the body of recommended techniques merits consideration by flight instructors in the field of their search for improved methods of dealing with troublesome training problems. The actual worthwhileness of instructional techniques or "tricks" can be definitively established only through experimental investigations designed to determine whether the use of a given technique results in the elimination of specific faults in increased flying proficiency as measured by other criteria. The compilation of "tricks" may suggest profitable areas of research on methods of flight training to interested research workers.

University of Pennsylvania
June 29, 1946

E. S. Ewart
A. S. Thompson
M. S. Viteles

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SUMMARY

Many individual flight instructors have developed specific teaching procedures or techniques which they find useful in their day-to-day flight instruction. Unfortunately, knowledge of a great many especially effective procedures is limited to instructors at single flight training schools, or at best to instructors in a rather restricted region. The purpose of this project was to provide for an extensive exchange of effective instructional procedures through the collection, from a wide sampling of representative flight instructors, of descriptions of instructional techniques which they had found particularly useful.

By means of a questionnaire descriptions of such instructional techniques which flight instructors in the field found useful were collected. A compilation was made of 341 techniques which had been submitted by 99 flight instructors who replied to the questionnaire. This compilation was then evaluated by instructor training personnel in the Armed Services, and by representatives of the General Inspection Division, CAA. Each of these men through use of an "Evaluation Booklet" assigned each of the techniques in the compilation to one of five categories:

A. "Good and not used by the great majority of flight instructors."

B. "Good, but commonly known and used by nearly all flight instructors at present."

C. "Good, but must be used with extreme caution."

D. "Serves limited purpose in special situations."

E. "Bad and should not be used."

Analysis of these evaluations indicated that while considerably more techniques were rated "B" than "A" by a relatively large number of judges, the majority of techniques was not classified as "E" by more than a relatively small number of judges, 190, or 56% of the techniques being classified "E" by fewer than 4 judges. Standards for selection of techniques to form the basis of a final compilation were set up. In order that the body of designated techniques could be considered as little suspect as possible, rather stringent requirements were set up in regard to the "E" category, any technique rated "Bad and should not be used" by more than 3 judges being eliminated from consideration.

Through application of these standards, 104 techniques (30% of the techniques originally submitted) were selected for inclusion in the final compilation. Of these, 3 were designated as "To be used with extreme caution," and 33 as "Serve limited purpose in special situations," whereas 68 were designated as "Aerodynamically correct and good from the viewpoint of instruction." An additional 35 techniques were designated as "supplementary." These latter techniques met the standards for the "E" classification, and although not meeting the standards for inclusion in terms of

the "A," "C," or "D" categories considered individually were classified either as "A" or "D" by 20% or more of the group of judges. None of the designated techniques were classified as "Good but in general use" by more than approximately 75% of the judges.

EVALUATION OF INSTRUCTIONAL TECHNIQUES DESCRIBED AS EFFECTIVE BY FLIGHT INSTRUCTORS

INTRODUCTION

One characteristic of pilots, and particularly of flight instructors, is the frequency and enthusiasm with which they engage in "hangar flying," i.e., in "bull sessions" during which common problems are discussed and common experiences shared. During these discussions details of specific instructional techniques or "tricks" which instructors have found particularly effective in their flight instruction are often exchanged. Although a few of the best of these special instructional methods have undoubtedly been carried from airport to airport by instructors who change jobs, or by itinerant pilots who happened to sit in on the "hangar flying" sessions at several airports, knowledge of a great many especially effective instructional techniques is limited to instructors at single flight training schools, or at best to instructors in a rather restricted region. The purpose of this project was to provide for an extensive exchange of effective instructional procedures through collecting, from a wide sampling of representative flight instructors, descriptions of instructional techniques which they had found particularly useful in their own day-to-day flight instruction.

It was anticipated that the best of these techniques which were submitted would be compiled in a manual and made available to all flight instructors. Such a manual would supplement rather than replace the regular Civil Aeronautics Administration Manual for Flight Instructors.[1] This manual, of course, supplies the essential information and describes the procedures and techniques which are the basic tools of the flight instructor. On the other hand, the experienced flight instructor will develop, over the years, a number of particularly effective instructional procedures which are not "in the books." A manual comprising a collection of instructional techniques of this sort would be of particular value to the young or inexperienced flight instructor who had not had opportunity to develop such "tricks" on his own. Moreover, any flight instructor interested in improving his instructional procedures would undoubtedly benefit from the experience of other instructors as presented in such a manual.

SURVEY OF FLIGHT INSTRUCTORS AND COLLECTION OF TECHNIQUES

In the spring of 1944, questionnaires (Exhibit 1) were mailed to 1237 flight instructors representing about 47% of the instructors serving in the CAA War Training Service Army and Navy flight instruction programs. The instructors were asked to describe (1) teaching techniques or "tricks" which in their own experience had proved particularly effective, and (2) troublesome instructional problems which they had en-

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[1] Flight Instructor Manual. Washington, D. C.: U. S. Department of Commerce, Civil Aeronautics Administration, September, 1941.

countered.[2] Ninety-nine replies to this questionnaire were received. The techniques were edited, expressed in comparable terminology, in some instances, condensed, and occasionally two or more suggested techniques extremely similar in nature, were combined.[3] In this original compilation which included 341 techniques, the fundamental nature or intent of the suggested techniques was not altered, and no selection or evaluation of the techniques submitted was made. The techniques were merely classified first in terms of whether they were "General Techniques," applying to more than one maneuver, or were "Techniques Specific to Individual Maneuvers." Techniques in the first of these broad categories were further classified in terms of the ten general instructional problems to which the various techniques referred, and under these classifications in terms of the specific instructional problems toward which given techniques were directed. In this connection, reference was made to the troublesome problems submitted by instructors. In view of the fact that every technique could not be paired with a problem which had been submitted, since only 50 problems in comparison with 341 techniques were contributed, advantage also was taken of the fact that in most cases the instructional problem toward which the technique was directed was stated explicitly or clearly implied by the contributor. Techniques specific to individual maneuvers were classified in terms of the 21 maneuvers to which the techniques referred and under this category a further classification was made in terms of the specific instructional problem involved. Reference to Appendix 1, the complete compilation booklet, will indicate the ways in which the various techniques were classified.

EVALUATION OF TECHNIQUES

The techniques were submitted for evaluation to instructor training personnel in the AAF and U.S.Navy, and to members of the General Inspection Division, Civil Aeronautics Administration. An Evaluation Booklet was prepared, the numbered pages of which corresponded to the pages in the Compilation Booklet, except that instead of the techniques being described, space was provided in which the evaluation of the technique could be indicated and in which comments could be entered regarding the technique. This Evaluation Booklet was to be used in conjunction with the Compilation Booklet. A sample page from the Evaluation Booklet is presented in Exhibit 2.

Each judge was asked to classify every technique into one of the following five categories:

Category A: "A" classification indicates that in the opinion of the judge the technique is aerodynamically correct, good from the viewpoint

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[2]In the present study only the suggested instructional techniques are treated specifically, although as noted following, instructional problems which were submitted were used in classifying the techniques.

[3]The compilation of techniques is presented as Appendix 1 to this report. In cases where two or more techniques were combined the number of instructors suggesting the technique is indicated by the figure in parentheses following description of the technique.

EXHIBIT 1

QUESTIONNAIRE USED IN A SURVEY
OF FLIGHT INSTRUCTORS

It will be interesting to know whether less experienced instructors have different problems than the more experienced instructors. In this connection, please answer the questions below:

How many hours of flying time have you logged? Approximately_____hours

How many hours have you logged as a flight instructor? Approximately_____hours

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LET'S HEAR FROM YOU TODAY

USE THE SELF ADDRESSED STAMPED ENVELOPE

(Use an extra sheet of paper, if necessary)

IN YOUR EXPERIENCE AS A FLIGHT INSTRUCTOR, WHAT PROBLEMS HAVE PUZZLED YOU MOST? Many instructors, for instance, have wondered what is wrong with a trainee who can do everything but land the plane. Or why do certain trainees "blow up" during emergency maneuvers?

DESCRIBE ON THE NEXT PAGE ANY SITUATIONS OR PROBLEMS THAT HAVE PARTICULARLY BOTHERED YOU. Describe them briefly, but explicitly and in terms of trainees' performance. Perhaps some other instructor of the hundreds being contacted will have been faced with a similar problem and has already worked out a solution.

(answer on next page)

(over)

NATIONAL RESEARCH COUNCIL
2101 Constitution Avenue, Washington 25, D.C.
Committee on Selection and Training of Aircraft Pilots

February 1, 1944

This is an invitation to contribute to a nation-wide "hangar flying" session of flight instructors.

We are asking you, as a representative flight instructor, to describe effective teaching "tricks" or methods which you have found useful in teaching flying. The ideas suggested by instructors from coast to coast will be compiled, published, and made available to all flight instructors.

You undoubtedly know some special ways of teaching or "tricks of the trade" which other instructors would find extremely valuable if they knew about them. We want to find out what they are. Describe them briefly in this folder—use another sheet of paper if necessary.

Don't think that the methods which you use must be complicated in order to be of interest to other instructors. Sometimes the simplest ones are best. One instructor, for example, cured a trainee of "dragging" his right wing when he levelled off before landing in the following way:- He taxied to a corner of the field, and for 15 minutes had the trainee practice pulling straight back on the stick, watching the ailerons to see that they didn't move. The instructor exerted enough resistance to the trainee's pressures to simulate the conditions of actual flight.

We are also interested in hearing about the training situations which you have found particularly puzzling. Those problems in pilot training which prove bothersome to a great number of flight instructors will be studied in the research program of the Civil Aeronautics Administration and the National Research Council Committee on Selection and Training of Aircraft Pilots.

By giving perhaps 15 minutes of your time in answering the questions on the following pages you can make a great contribution to the war effort, as well as to the profession of flight instruction. Perhaps you may be able to prevent a washout or save a life.

The sooner you respond the sooner the collection can be published, and made available to you, as well as to instructors who may not have had sufficient experience to develop helpful methods or "tricks" of their own. Of course, while your name will be listed among cooperating instructors, you will not be quoted directly without permission.

Use the self-addressed stamped envelope—Let's hear from you today!

M S Viteles

Morris S. Viteles, Chairman
Committee on Selection and
Training of Aircraft Pilots,
National Research Council

D. R. Brimhall

Dean R. Brimhall
Director of Research
Civil Aeronautics Administration

(over)

WHAT SPECIAL TEACHING METHODS HAVE YOU FOUND EFFECTIVE in dealing with specific problems of individual trainees, or in teaching specific maneuvers? If one of your trainees developed a persistent fault or error and you used a specific technique for correcting that error, describe how you handled the situation. Or if you have "invented" an effective method for teaching specific maneuvers, for example, steep turns, stalls, spin entries, landings, etc., describe your method of introducing and teaching the maneuver.

WHAT METHODS HAVE YOU USED TO "CURE" A TRAINEE who had appeared to be "hopeless" — Again be specific. For example, if his chief difficulty was poor coordination, tell how you improved his coordination. If his trouble was overcontrolling, tell what you did about it.

EXHIBIT 2

SAMPLE PAGE FROM EVALUATION BOOKLET

EVALUATION OF INSTRUCTIONAL TECHNIQUES

I. PRESENTATION OF MATERIAL

Training problem	Technique number	Rat. A	B	C	D	E	Comments
A. Adequate ground instruction.	1.						
	2.						
	3.						
	4.						
	a.						
	b.						
	c.						

EXHIBIT 2

Sample page from Evaluation Booklet

[illegible] and [illegible] by the majority of flight instructors

Category B: "B" classification indicates that in the opinion of the judge the technique is aerodynamically correct, good from the viewpoint of instruction, but commonly known and used by nearly all flight instructors at present.

Category C: "C" classification indicates that in the opinion of the judge the technique is aerodynamically correct, good from the viewpoint of instruction, but must be used with extra caution and only in dual flight.

Category D: "D" classification indicates that in the opinion of the judge the technique might serve a useful but limited purpose as an instructional aid in special situations.

Category E: "E" classification indicates that in the opinion of the judge the technique is bad, and should not be used. Judges were requested to explain in the column headed "Comments," their reasons for classifying a technique "E."

Completed Evaluation Booklets were received from 49 men. On the basis of the reports from these judges the final evaluation of the techniques was made.

RESULTS

Distribution of Ratings in the Five Categories. In Table 1 are presented the distributions of ratings with reference to the five categories in terms of which the techniques were rated. Separate distributions are presented for Part One of the compilation (General Techniques), Part Two (Techniques Specific to Individual Maneuvers), and for the total compilation. The stated frequencies in the left hand column of each of the three subdivisions of this table represent the number of judges who gave a specific rating. Each entry in the cells under the column headings "A," "B," "C," "D," and "E" indicates the number of tricks given the rating indicated by the column heading, by the number of judges indicated by the row designation. For example, referring to Part One the entry in the first cell under "A" indicates that 15 techniques in Part One of the compilation were designated as in the "A" category by between 0 and 4 of the judges. Similarly, referring to "Total Compilation," 219 of the total of 341 techniques were rated as "E," or "Bad and should not be used" by less than 5 judges.

Examination of Table 1 indicates that few tricks were rated "A" (Good and not in general use) by the majority of the judges, only 5 of the 341 techniques being given a rating of "A" by 25 (approximately 50%) or more of the 49 judges. 90 or 26% of the techniques were rated "A" by 10 (20%) or more of the judges. On the other hand, 150 or 44% of the techniques which were submitted were considered as "Good but used by nearly all flight instructors at present" by more than approximately 50% of the judges.

TABLE 1

DISTRIBUTIONS OF RATINGS

Number of techniques assigned to various categories by specified number of judges

	PART ONE				
	A	B	C	D	E
0-4	15	15	65	36	56
5-9	32	10	20	16	11
10-14	20	7	3	18	11
15-19	10	5	0	15	4
20-24	7	3	0	2	2
25-29	2	3	0	0	3
30-34	2	11	0	0	0
35-39	0	8	0	0	1
40-44	0	8	0	0	0
45-49	0	8	0	0	0
Total	88	88	88	88	88

	PART TWO				
	A	B	C	D	E
0-4	102	12	192	63	162
5-9	102	24	43	75	54
10-14	34	36	17	46	23
15-19	12	28	1	38	8
20-24	2	38	0	21	4
25-29	1	36	0	9	1
30-34	0	22	0	1	1
35-39	0	35	0	0	0
40-44	0	17	0	0	0
45-49	0	5	0	0	0
	253	253	253	253	253

	TOTAL COMPILATION				
	A	B	C	D	E
0-4	117	27	257	99	219
5-9	134	34	63	91	62
10-14	54	43	20	64	34
15-19	22	36	1	54	12
20-24	9	51	0	23	6
25-29	3	47	0		4
30-34	2	30	0		1
35-39	0	43	0	0	1
40-44	0	25	0	0	0
45-49	0	5	0		0
	341	341	341	341	

Relatively few tricks, however, were rated in the "E" category as "Bad and should not be used." Two hundred and nineteen (or 64%) were rated "E" by less than 5 judges. Only 58 (or 17%) of the total of 341 techniques suggested were given this classification by 10 or more judges (approximately 20% of group), and only 6 techniques were rated "E" by more than 25, or approximately 50% of the 49 judges. A slightly greater proportion of "General" techniques appear to be classified as "Bad" by 10 or more judges than is the case in respect to techniques specific to individual maneuvers. Relatively few techniques are classed as "Good but must be used with extreme caution," only 21 of the 341 techniques being classified in this category by more than 10 (approximately 20%) of the judges. A somewhat greater proportion of this sort of techniques were in reference to specific maneuvers than were "General" in nature. A considerable number of techniques were rated "D," as "serving a limited purpose in special situations." Forty-four per cent of all tricks were rated thus by 10 or more instructors, but only 3% of the techniques were given this rating by 25 or more judges.

The general picture presented by these distributions is that while considerably more tricks are rated "B" than "A" by a relatively large number of judges, comparatively few techniques are classified "E" as "Bad and should not be used" by more than a relatively small number of judges. It should be noted that one of the reasons that relatively few techniques were classified either "A" or "D" by a majority of the judges is that the classification of a number of techniques rated "E" by only a few judges, were split between the "A" and "D" categories by a majority of the remaining judges. See for example technique C, 2, a, Section I of the Compilation (Appendix 1, page 44). This technique, rated "E" by only 2 judges, was classified as "A" by 18 judges, as "D" by 18 judges. In few cases, of course, is the division as even as in this instance. However, many techniques classified as "A" by a relatively large number of judges are placed in the "D" category by quite a few of the other judges.

Cross Tabulation Between "A" and "E" Categories. In order to obtain a clearer picture of the evaluations of the techniques by the judges it proved desirable to make cross tabulations by means of which the evaluation of each trick by the group of judges in terms of one category could be presented in relation to the evaluation of the trick in another category. It was desired to know, for example, not only how many judges rated a trick as "A" but the number rating it "A" in comparison with the number who rated it "E."

In Figure 1 is presented the cross tabulation of techniques in respect to categories "A" (Good and not in general use) and "E" (Bad and should not be used). The frequencies on the ordinate and abscissa of this figure refer, as in the case of Table 1, to the number of judges who gave a specific rating. The entries in each cell of the table indicate the number of tricks rated "A" by the number of judges indicated on the ordinate, and also rated "E" by the number of judges indicated on the abscissa. For example, 53 tricks were rated as "A" by less than 5 judges, and "E" by less than 5. Similarly, it is evident that 2 techniques were rated "A" by between 30 to 34 of the judges, and "E" by less than 5. Inspection of Figure 1 indicates that only 3 techniques classified as "A" by 15 or more judges, were

also classified as "E" by more than 4 judges.

In as much as this cross tabulation represents one of the most critical comparisons, examination of certain of the techniques which were rated predominantly "Good and not in general use," and predominantly "Bad and should not be used" seems indicated. Five suggested techniques were classified as "A" by approximately 25 (or 50%) or more of the judges, and as "E" by less than 5 (or 10%) of the judges. These suggested techniques are as follows:

1. "Have the trainee talk to you as if he were the instructor and you the trainee, explaining as he goes along just what, when, and where he is going to change the attitude of the airplane, and why he plans to do it, what he is going to do next, where the wind is, etc." (This technique was rated "A" by 31 judges, "E" by 1 judge.)

2. "Following solo practice, spend at least 30 minutes with the trainee on ground at end of flight, answering all his questions." (This technique was rated "A" by 30 judges, "E" by 1 judge.)

3. "When a mistake is made, instead of telling the trainee what he did wrong, ask the trainee to tell you." (This trick was rated "A" by 28 judges, "E" by 1 judge.)

4. "Always try to put yourself in the trainee's place and realize that just because you demonstrate the maneuver expertly is no reason for believing that the trainee has understood your explanation of it." (This trick was rated "A" by 29 judges, "E" by no judge.)

5. "To impress the trainee with the difference between track and heading, use a spring-driven toy running across a sheet of celluloid or cellophane laid on top of a chart or table, the transparent sheet representing the air mass, and the chart the ground. By pulling the cellophane one can simulate gentle or strong winds from any direction and most convincingly demonstrate the difference between track through the air and track over the ground." (This trick was rated "A" by 29 judges, "E" by one judge.)

Six tricks were rated as "E" (Bad) by 25 or more judges (50% or more) and "A" by less than 5 (10%) of the judges. These suggested techniques are as follows:

1. If the trainee fails to keep his hand on the throttle "Tie the trainee's left hand to the throttle and keep it tied there throughout one lesson period." (This trick was rated "E" by 35 judges, "A" by 3 judges.)

2. To improve rudder control on take-off "teach trainee to 'fan the tail' using short, abrupt movements of the rudder." (This technique was rated "E" by 33 judges, "A" by no judges.)

3. If trainee overcontrols rudder "each time the trainee starts to make a turn (or other maneuver) push on the controls without his suspecting that you are going to do so, until it becomes apparent to him that each time he executes a maneuver the execution will be violent unless his

pressures or movements of the controls are lessened." (This technique was rated "E" by 27 judges, "A" by 1 judge.)

4. If trainee overcontrols rudder "fly the trainee in rough air, riding all controls to make them extra heavy. Follow this by a session of flying hands off." (This technique was rated "E" by 28 judges, "A" by 2 judges.)

5. In combating airsickness "say to the trainee 'Okay son, I'll take over while you hang your head out the window and get rid of it then get back to flying this thing yourself.'" (This technique was rated "E" by 29 judges, "A" by no judges.)

6. To improve rudder control on take-off "have the trainee stiffen his legs slightly with his feet on the rudder to prevent overcontrolling." (This technique was rated "E" by 25 judges, "A" by one judge.)

It is of interest to examine the suggested techniques in regard to which the judges, as a group, were "ambivalent." Examination of Figure 1 indicates that 4 techniques were rated "A" by between 10 and 14 judges (approximately 20 to 30 per cent of the group) and "E" by 10 to 14 judges. These four tricks are as follows:

1. To combat trainee tenseness in stalls and other violent maneuvers "demonstrate or have the trainee do a mild stall...(pushing) the stick far enough forward so that there is a sensation of not sitting on the seat. While the plane is coming up into the unusual climb position, tell the trainee 'expell all air from your lungs down to the bottom of your toes.'" Then as the plane dips down, say "Take a deep breath." At the completion of the maneuver ask "Did you feel any particular sensation?" The trainee will always answer "Yes." Then repeat the maneuver, this time using a different breathing procedure. As the plane comes up to the top of the climb position ask the trainee to take a full deep breath of air. As the plane goes down ask him to expel all air. When asked if he felt any peculiar sensation the trainee will answer "No." By repeated demonstration show the trainee that relaxation in this maneuver can be aided by proper breathing.

2. To combat airsickness "Frame up with another instructor who has a more advanced trainee...Duplicate some of the other fellows more simple acrobatics and then take the trainee back to the airport before he has time to think about getting sick. Then tell him in all seriousness what a rough ride it was, and how anybody who can go through that need never worry any more about getting airsick."

3. To improve coordination in turns "Have trainee practice at home with a chair and a broom stick, moving feet and stick together to develop his leg-hand coordination."

4. To improve estimation of gliding speed "If trainee watches the airspeed too much leave the pitot cover on for a few flights."

It will be noted that the techniques presented on the preceding page on the basis of their classification in terms of the cross tabulation between categories "A" and "E," are of three rather distinct types. Techniques predominantly classified as "A" include applications of recognizably sound teaching principles, or as in the case of the technique which illustrates the difference between "track" and "heading," represent clever methods of clarifying a concept which, traditionally, has been difficult for student pilots to understand. Techniques predominantly classified as "E" in general embody principles which are recognizably unsound, either from the standpoint of educational principles or on the basis of the fact that inefficient or dangerous operations from the standpoint of safe flying are included. The techniques regarding which the group of judges were "ambivalent" are perhaps of the most interest. The procedure involving practice with a broom stick, for instance, which at one time apparently was considered quite good, has evidently fallen into some disrepute. The principal reason given for classifying this technique is "E" or "Bad" was that in such practice the live pressures on the controls were not duplicated.

It should also be noted that some of the techniques predominantly classified as "A" while being perhaps more sound are not, in general, as spectacular or as unique as certain other techniques which were classified as "D" techniques, or for which the classifications were split between categories "A" and "D." For example, one of the techniques which was given no "E" ratings and which was rated "D" by 25 judges is as follows:

1. If trainee forgets flight path sequence for low-work maneuvers "Take him to the hangar floor, laid off in squares, and have him walk through the maneuvers stating beforehand the wind direction and using his arms to show the degree of bank at various positions."

Cross Tabulation Between "A" and "B" Categories. In view of the large number of techniques that were classified as "B" (Good but used by nearly all instructors at present), examination of the cross tabulation between the "A" and "B" classifications is also of interest. This cross tabulation is presented in Figure 2. It will be noted that techniques which are classified "A" by a relatively large number of judges in a number of cases are also classified "B" by a relatively large number of judges. Of the five techniques which received "A" ratings by 25 (approximately 50%) of the judges, one was rated "B" by between approximately 40 to 50% (between 20 and 24 judges) one was rated "B" by between 10 and 14 judges, 2 by between 5 and 9 judges and only one by less than 5 judges. It should be noted, however, that due to the fact that the group of judges represented highly experienced flight instructors, many techniques considered generally familiar by them might not be familiar to instructors in general.

In Figure 3 is presented the cross tabulation between categories "A" and "C" (Good but must be used with extreme caution). Although as noted previously, relatively few techniques are rated "C" by an appreciable

Number of judges assigning A classification	Number of judges assigning E classification								
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	Total
30-34	2								2
25-29	3								3
20-24	8	1							9
15-19	20	2							22
10-14	40	10	4						54
5-9	93	22	12	5	2				134
0-4	53	29	18	7	4	4	1	1	117
Total	219	64	34	12	6	4	1	1	341

FIGURE 1

CROSS TABULATION OF TECHNIQUES IN TERMS OF CATEGORIES A AND E

Number of judges assigning A classification	Number of judges assigning B classification										
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total
30-34	1	1									2
25-29	0	1	1	0	1						3
20-24	1	1	3	0	3	1					9
15-19	0	4	4	2	6	5	1				22
10-14	3	1	6	4	12	8	8	12			54
5-9	9	8	17	17	17	20	13	19	14		134
0-4	13	18	12	13	12	13	8	12	11	5	117
Total	27	34	43	36	51	47	30	43	25	5	341

FIGURE 2

CROSS TABULATION OF TECHNIQUES IN TERMS OF CATEGORIES A AND B

number of judges, no technique rated "A" by 15 or more judges was also rated "C" by 15 or more. On the other hand, 20 techniques which were rated "C" by 10 or more judges were rated "A" by less than 10. These are the techniques which in this regard can probably best be clearly differentiated from the "A" techniques.

In Figure 4 is presented the cross tabulation between categories "D" (Possibly good in special situations) and "E" (Bad and should not be used). Inspection of this figure indicates that when these two categories are compared there is much less agreement between the judges as to how given techniques should be classified than was the case for other comparisons. This, of course, might be expected from the nature of the two categories, in as much as in regard to a number of the items there was undoubtedly considerable indecision as to whether they were "Bad," or "Possibly useful in special situations." On the other hand, as noted previously, there was undoubtedly indecision as to whether certain techniques should be classified "A" or "D." Some techniques classified as "E" by only a few judges were placed in category "A" by approximately the same number of judges as classified them "D."

Cross Tabulation Between "C" and "E" Categories. In as much as no more than a relatively small number of judges rated any trick as "C" (Good but to be used with caution), it is of interest to examine the cross tabulation between categories "C" and "E," since under these conditions it might be expected that tricks classified as "C" by some judges would be classified as "E" by a greater number of judges. In Figure 5 is presented the cross tabulation of techniques rated "C" by five or more judges, in terms of categories "C" and "E." (It should be emphasized that in this cross tabulation, techniques rated "C" by less than five judges are not considered.) Inspection of Figure 5 indicates that of the 84 techniques classified as "C" by 5 or more judges, 20 of the techniques were classified as "E" by more judges than classified them "C." Of the 21 techniques classified as "C" by 10 or more judges, only 9 received "E" classification by less than 5 judges.

Cross Tabulation Between "A" and "D" Categories. Finally, it is of interest to examine the cross tabulation between categories "A" and "D" (Possibly good in special situations). In Figure 6 is presented this cross tabulation for techniques rated "D" by 10 or more judges and "E" by less than 10 judges. Of these 103 techniques, 87 were classified as "D" by more judges than classified them "A." Eighty-one of the 103 techniques were classified as "D" by more than 10 judges and "A" by less than 10. It is apparent that while there was some overlap between the categories the "D" classification singled out a number of techniques serving a distinctly different purpose than many of those classified as "A."

Number of Techniques Classified in Each Category by Each Judge. In Table 3 is presented the number of techniques classified in each category by each of the 49 judges. In Table 4 are presented frequency distributions of the data presented in Table 3. The left hand column of this table indicates the number of techniques classified in a given category. The en-

Number of judges assigning A classification

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Total
30-34	1	1						2
25-29	3	0						3
20-24	9	0						9
15-19	18	4						22
10-14	50	3	1					54
5-9	102	21	10	1				134
0-4	74	34	9	0				117
Total	257	63	20	1				341

FIGURE 3

CROSS TABULATION OF TECHNIQUES IN TERMS OF CATEGORIES A AND C

Number of judges assigning E classification

Number of judges assigning D classification

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Total
30-34	0	0	1					1
25-29	3	4	2					9
20-24	7	8	5	2	1			23
15-19	19	15	13	3	2	2		54
10-14	31	16	7	6	2	1	1	64
5-9	68	15	6	1	0	1	0	91
0-4	91	6	0	0	1	0	1	99
Total	219	64	34	12	6	4	2	341

FIGURE 4

CROSS TABULATION OF TECHNIQUES IN TERMS OF CATEGORIES D AND E

Number of judges assigning C classification

	Number of judges assigning E classification							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Total
30-34								
25-29								
20-24								
15-19	1							1
10-14	8	6	5	1				20
5-9	29	15	11	4	2	2		63
0-4								0
Total	38	21	16	5	2	2		84

FIGURE 5

CROSS TABULATION OF SELECTED C TECHNIQUES IN TERMS OF CATEGORIES C AND E
(selected C techniques include those rated C by 5 or more judges)

Number of judges assigning A classification

	Number of judges assigning D classification							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Total
30-34			1					1
25-29			0					0
20-24			3	1				4
15-19			3	4				7
10-14			4	6				10
5-9			18	13	9	1		41
0-4			18	10	6	6		40
Total			47	34	15	7		103

FIGURE 6

CROSS TABULATION OF SELECTED D TECHNIQUES IN TERMS OF CATEGORIES A AND D
(selected D techniques include those rated D by 10 or more judges
[illegible])

tries in the columns headed "A," "B," "C," "D," "E," and "Omit" indicate the number of judges who gave the classification indicated by the column heading to the number of techniques indicated by the row designation. For example, referring to the first heading under "A," 1 judge gave "A" classification to between 0 and 9 techniques, six judges gave "A" classification to between 10 and 19 techniques, etc.

The data in Table 3 are arranged in ascending order in terms of the number of "E" classifications given by the judges. In regard to this category it is noteworthy that one judge considered only 2 techniques as "Bad and should not be used," whereas another judge assigned 112 techniques to this category. The median number of techniques assigned the "E" classification was 32. The considerable range in the number of tricks considered "Bad and should not be used" by the 49 judges indicates pronounced disagreement regarding the proportion of the techniques which fell into this category.

Similarly, inspection of Tables 3 and 4 indicates a relatively wide range in the number of techniques classified in the other categories. The number of techniques classified as "B" (Good but in general use) ranged from 85 to 271, the median number being 140. It is significant that the fewest number of techniques considered "Good but in general use" by any one judge represented approximately 25% of the total, whereas one judge classified almost 80% of the techniques in category "B." In regard to the "A" classification, one judge classified only 6 techniques as "Good and not in general use." It is of interest to note that the number of techniques classified as "C," "D," and "E" respectively by this judge (Number 19) was only slightly above the median for the group as a whole, the bulk of the techniques being classified by this individual as "Good but generally in use." The maximum number of techniques classified as "A" by any one judge was 155, representing 45% of the total number.

The maximum number of techniques classified as "D" by any one judge was 178. Disregarding the judge who omitted 213 of the techniques, the minimum number of techniques classified as "D" was 8. Relatively few techniques were classified in category "C" (Good but to be used with extra caution) by any of the judges, the maximum being 54 and the minimum 1, the median number being 18. As noted previously, one judge omitted 213 techniques although the median number of techniques omitted was only 5.

As might be expected, the general picture drawn from examination of number of judges assigning specified numbers of techniques to the various categories, as presented in Tables 3 and 4, is essentially the same as that presented by the tabulation of the number of techniques assigned to the various categories by the group of judges as a whole, as presented in Table 2. However, the significant feature revealed by examination of Tables 3 and 4 is the marked individual differences among members of the group of judges in the number of techniques classified in the various categories. Evidence of individual differences in terms of the number of techniques assigned to categories "A," "B," "C," and "D" might perhaps be expected in view of the fact that techniques in this category were all considered

TABLE 3

NUMBER OF TECHNIQUES CLASSIFIED IN EACH CATEGORY BY EACH OF THE 49 JUDGES

	A	B	C	D	E	Omit
1.	28	214	15	73	2	9
2.	77	222	15	8	3	16
3.	82	132	46	71	4	6
4.	59	140	7	124	5	6
5.	50	190	31	61	8	1
6.	23	89	4	3	9	213
7.	63	208	5	43	11	11
8.	12	271	8	38	12	0
9.	14	130	1	178	13	5
10.	47	218	11	49	14	2
11.	16	245	30	26	16	8
12.	62	158	22	82	16	1
13.	63	130	22	94	17	16
14.	12	250	34	12	17	16
15.	78	145	18	65	17	18
16.	16	209	29	55	19	13
17.	30	229	6	55	19	2
18.	103	177	28	10	19	4
19.	6	215	31	67	21	1
20.	155	120	21	21	21	3
21.	26	188	18	82	21	6
22.	39	195	9	76	21	1
23.	57	132	39	87	23	3
24.	26	186	15	81	27	6
25.	60	169	30	49	32	1
26.	48	141	50	66	32	4
27.	76	137	49	45	33	1
28.	63	98	37	103	35	5
29.	114	132	26	29	37	3
30.	62	110	28	96	38	7
31.	27	139	1	129	38	7
32.	55	127	22	97	39	1
33.	38	160	12	92	39	0
34.	51	127	51	66	44	2
35.	70	98	13	90	44	26
36.	105	124	17	50	45	0
37.	39	198	16	24	48	16
38.	81	85	6	111	48	10
39.	73	103	25	91	49	0
40.	23	122	34	109	49	4
41.	23	199	21	40	53	5
42.	43	113	10	68	54	53
43.	55	120	54	49	55	8
44.	17	185	11	68	59	1
45.	39	183	8	46	62	3
46.	53	115	17	74	62	20
47.	22	94	46	101	70	8
48.	81	100	16	53	82	9
49.	70	91	10	50	112	8
Median	51	140	18	66	32	5

TABLE 4

NUMBER OF TECHNIQUES CLASSIFIED IN EACH CATEGORY BY INDIVIDUAL JUDGES

Number of Techniques Classified in Given Category	A	B	C	D	E	Omit
0-9	1		10	2	6	37
10-19	6		15	3	12	8
20-29	8		10	3	6	2
30-39	5		8	1	9	0
40-49	3		3	7	7	0
50-59	7		3	5	4	1
60-69	6			7	2	
70-79	6			4	1	
80-89	3	2		4	1	
90-99	0	4		6		
100-109	2	2		3		
110-119	1	3		1	1	
120-129	0	6		2		
130-139	0	7				
140-149	0	3				
150-159	1	1				
160-169		2				
170-179		1		1		
180-189		4				
190-199		4				
200-209		2				
210-219		3				1
220-229		2				
230-239		0				
240-249		1				
250-259		1				
260-269		0				
270-279		1				
	49	49	49	49	49	49

satisfactory, and differences of opinion in their exact classification would not seem unusual. However, the marked differences of opinion evidenced in the number of techniques to be considered "Bad and should not be used" is noteworthy.[4]

Standards Used in Selection of Techniques for Final Compilation. In selecting techniques for inclusion in the final compilation it was necessary to set specific standards, on the basis of ratings made by the group of judges, in terms of which certain techniques could be eliminated and others included. While without question techniques rated "E" (Bad and should not be used) by more than a few judges should be eliminated, it could be argued on the one hand that only those superior techniques having high ratings in terms of the "A" classification and low ratings in terms of the "B" classification should be included. In support of this position it could be pointed out that the final compilation would be most effective if only outstanding techniques were presented.

On the other hand, the position could be taken that it is desirable to include as many techniques as possible, the principal interest being that the techniques included are not "bad" techniques. In support of this point of view it could be emphasized, for example, that certain specific techniques might be found useful by individual instructors, particularly those with little experience, even though a relatively great proportion of the group of judges considered them "Good but in general use."

This latter point of view was assumed in setting up standards in terms of which the techniques to be included in a tentative final compilation have been selected.[5] It was decided arbitrarily that techniques classified as "A," "C," or "D" by 10 (20%) or more of the judges would be included. The designation of this "cut-off," although arbitrary, was based on the judgment that this figure represented a reasonable percentage in terms of which a maximum number of potentially useful techniques would be included, and which the same time would exclude a maximum number of the techniques which represented essentially "dead wood." However, provision also was made for including and designating as "supplementary," techniques whose combined "A" and "D" ratings met the standards for either "A" or "D" categories alone, i.e., which were rated "A" or "D" by 10 or more judges.

The critical issue, however, was the determination of the cut-off point for the "E" classification, since except for the elimination of the "dead wood," according to the philosophy in terms of which the selection was made

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[4]Except as noted following (see footnote 6) detailed data unfortunately are not available by means of which the wide divergences in standards among individual judges could be explained in terms of differences in experience and background.

[5]It should be noted, however, that the work sheets from which the cross tabulations were prepared indicate the status of each technique in terms of each cross tabulation comparison. From these work sheets the techniques included on the basis of any desired set of standards can rapidly be determined.

the principal consideration was that the techniques should not be considered "Bad," as indicated above. The body of techniques which met the standards for inclusion in terms of the "E" category would, in effect, represent the basic group, the individual techniques constituting this group then being designated as "A," "C," or "D" provided they met the standards for these groups as noted previously.

In determining the cut-off point for the "E" classification in terms of which techniques would be excluded from the final compilation, it appeared desirable to examine the number of techniques classified as "E" by from 0 to 4 judges. The cross tabulation of techniques classified as "E" by less than 5 judges, in terms of the "A" and "E" categories is presented in Figure 7. In considering where this cut-off point should be placed, cognizance was taken of the fact that techniques included in the final compilation should not be classified as "E" by more than a very few judges. Examination of Figure 7 indicates, however, that it would be unwise to exclude techniques classified as "E" by any judge, in as much as of the 5 "best" techniques classified as "A" by 25 (approximately 50%) or more of the judges, only one failed to receive an "E" classification by some one judge. Examination of these techniques presented on page 17, suggests that they represent apparently sound educational procedures even though classified as "E" by one of the judges. Moreover, techniques classified as "A" by as many as 20 to 24 of the judges (between 40 and 50% of the group) were also classified as "E" by as many as 3 judges.

The fact that there were marked differences in the number of techniques classified as "E" was also taken into consideration in setting the cut-off point.[6] As noted previously, one judge placed 112, or 33% of the techniques in the "E" category. Moreover, two others classified as many as 70 or 21% of the techniques in this category, whereas the median number assigned "E"

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[6]As noted previously, the majority of the judges were representatives from the instructor training personnel in the Army and Navy Air Forces. Actually, with the exception of nine inspectors from the General Inspection Division, Civil Aeronautics Administration, all but one or two of the remaining men serving as judges were from the Navy. It was therefore of importance to determine whether the number of techniques classified into the respective categories (particularly the "E" category) by the CAA inspectors differed significantly from the number of techniques classified in the respective categories by the judges who were more actively engaged in instruction or in instructor training.

Application of the "epsilon squared" technique indicated that the inspectors differed from the remainder of the group of judges only in the number of techniques classified as "A." The inspectors tended to classify a somewhat greater number of techniques as "Good and not in general use," the difference being significant at between the 5% and 1% levels of confidence. In respect to the other categories no significant differences were evident however. With respect to category "E" which is of particular importance since the limits in regard to this category were so stringent, the comparison of the inspector distribution with the distribution for the remaining judges yielded an epsilon squared of .00

Number of judges assigning A classification	Number of judges assigning E classification					
	0	1	2	3	4	Total
30-34	0	2				2
25-29	1	2				3
20-24	5	2	0	1		8
15-19	10	2	4	4		20
10-14	15	14	8	2	1	40
5-9	33	20	13	8	19	93
0-4	8	13	12	11	9	53
Total	72	55	37	26	29	219

FIGURE 7

CROSS TABULATION OF SELECTED E TECHNIQUES IN TERMS OF CATEGORIES A AND E
(selected E techniques include those rated E by less than 5 judges)

classification was only 32 or about 9% of the total. These facts represented further evidence indicating that elimination of all techniques classified as "E" (Bad and should not be used) by one or more of the judges would be unwise.

On the other hand, the techniques all are of unknown "validity," i.e., although having been found useful by given instructors, the group of judges evaluated the techniques on the basis of *a priori* judgments rather than on the basis of determining their effectiveness by means of actual try-out in the field. In view of this fact it was particularly important that none of the techniques selected be in any way suspect. In light of this premise it was decided arbitrarily that techniques classified as "E" by as many as five judges should not be considered for inclusion in the final manual. In view of the decision noted previously, to include all techniques designated "A" by 10 or more judges, it was therefore decided to set the cut-off point for the "E" classification between 1 and 4 judges, at such a point that the maximum number of techniques classified "A" by 10 or more judges would be included, but at the same time including only techniques assigned "E" classification by as small a number of judges as possible. Examination of Figure 7 indicates that by excluding all techniques assigned "E" classification by more than 3 judges, only one of the 73 techniques rated "A" by 10 or more and "E" by less than 5 of the judges is excluded. It was decided, there-

fore, that all techniques classified as "E" by more than 3 judges should be excluded from the final compilation, the same cut-off point in terms of the "E" category to be used in selecting "C" and "D" techniques. In these terms the techniques selected for the final compilation were determined and designated as follows:

1. All techniques classified as "E" by more than 3 judges were eliminated.

2. All techniques not classified as "A," "C," or "D" by 10 or more judges were eliminated.

3. Techniques included in the final compilation were designated as "A" techniques (aerodynamically correct and good from the viewpoint of instruction), "C" techniques (aerodynamically correct, good from the viewpoint of instruction, but to be used with extra caution and only in dual flight), or as "D" techniques (aerodynamically correct but serving a limited purpose in special situations) depending upon the category in which they were classified by the greatest number of judges. In cases in which exactly the same number of judges classified a technique in the "A" and "D" categories, the technique was given an "A" designation. There were no tricks classified in "C" by exactly the same number of judges who assigned them "A" or "D" classifications.[7]

Number of Techniques in Each Category Included in Final Compilation.[8] On the basis of the final analysis there were included in terms of the

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[7]Question might be raised regarding the advisability of inclusion of category "B" (Good but in general use) in the evaluation procedure in as much as this category has not been treated specifically in this analysis. It should be noted, however, that inclusion of a technique in category "B" by a number of judges reduced the number who assigned the technique to other categories. In as much as in order to be included in either "A," "C," or "D" categories in the final compilation it was necessary for a technique to be given that designation by at least 20% of the judges, no technique classified "B" by more than 80% of the judges could be included in the final compilation. Actually, no technique classified "B" by more than about 75% of the group was included.

[8]It should be noted that the following figures and the figures in Table 2 do not agree exactly with the comparable entries presented in the cross tabulations. The cross tabulations represented a preliminary classification in which numbers of judges assigning given classifications were expressed in class intervals. Final analysis and comparison of the actual frequencies resulted in 4 "A" techniques being shifted to the "D" classification. This resulted from the fact that these techniques fell in the same class interval under both "A" and "D" distributions, and were therefore assigned to "A" in the preliminary analysis. In the final analysis, however, it was found that four of these techniques actually were classified as "D" by one or two more men than classified them "A." They were therefore shifted to the "D" classification.

standards outlined above, 68 techniques designated as "A" (Good from the viewpoint of instruction), 3 techniques designated as "B" (Good but to be used with extreme caution and only in dual flight), and 33 techniques classified as "D" (serve limited purpose in special situations). The 104 techniques which were included represent 30% of the 341 techniques originally submitted by the flight instructors. These 104 techniques are indicated in the original compilation attached as Appendix 1 to this report, "A" techniques being enclosed by purple boxes, "C" techniques by red boxes, and "D" techniques by green boxes.

Designation of "Supplementary" Techniques. In addition, it was observed that a number of techniques classified as "E" by three or fewer instructors were just under the limits for inclusion in both the "A" and "D" groups, although not meeting the standards for each group. Apparently part of the group of judges had split their classifications between these two groups. For example, technique C, 2, a, in Section XXVI of the compilation (page 97, Appendix 1) was classified as "E" by none of the judges, and as "A" and "D" by 8 and 7 judges, respectively. It was felt that certain of the techniques might be of interest which were classified as "E" by three or fewer judges and for which the total number of judges classifying them "A" or "E" exceeded 10, the minimum for classification in either category considered individually. The 35 additional techniques in which the "A" and "E" classifications were split in the manner described above are indicated in the compilation (Appendix 1) by enclosure in broken lines. Consideration may be given to the inclusion of these techniques in the final compilation, although they probably do not represent in general as clearly adequate techniques as those defined by the standards as originally stated. For the purposes of the present report, these techniques can be considered to represent a supplementary designation.

Techniques Excluded from Compilation. It is recognized that in setting rather stringent requirements in regard to the "E" classification, a number of potentially good techniques might be excluded because of the fact that they ran counter to particular idiosyncracies which several judges by chance possessed in common. Elimination of a few techniques on such grounds, however, was considered a necessary price to insure that, as a whole, none of the techniques could be considered suspect. Nevertheless, it is of interest to examine briefly a few of the techniques which were excluded by narrow margins.

Reference to Figure 1 indicates that one technique, although classified as "A" by between 20 and 24 judges, was also classified as "E" by between 5 and 9 judges, and was therefore excluded. This technique, E-1 in Section II of the compilation (Appendix 1, page 47) was classified "A" by 21 judges, "D" by 11, and "E" by 8 men. As reference to the Appendix will indicate, the technique is designed to demonstrate to a trainee, who is convinced his poor coordination cannot be overcome, that he evidences as complex coordination in driving a car as is required in flying.

Representative of the comments made by judges who designated this technique as "Bad and should not be used" are the following:

"Haven't time for this kind of nonsense in flying;"

"This would be a waste of time and it has little or no bearing on flying;"

and more constructively:

"Not a natural outlook on student's part -- too complex -- same thing could be demonstrated without so much trouble (lighting cigarette)."

Only one potentially acceptable "A" technique was rated "E" by exactly 4 judges, just one over the limit, and this technique was given "A" classifications by only between 10 and 14 judges. However, a number of techniques which were rated "D" by 20 or more judges and which were rated either "D" or "A" by a still larger number, were nevertheless eliminated on the basis of "E" ratings by exactly 4 judges, just one over the maximum. It is of interest to examine some of these techniques briefly and to note the comments of the judges who considered them "Bad and should not be used."

Technique E-C-4 in Section XXVI (Appendix 1, page 99) was classified as "D" by 25 judges, "A" by 3 more, and "E" by four. The essence of this suggestion was that if the trainee was having difficulty with landings he should be told that there is one more maneuver to be taken up, namely, "Power-off-landing-prevention." He was then to be instructed on landings to keep the plane flying in the air just above the ground as long as possible. Examples of comments on this technique were "Don't understand," "That should keep the student worrying for a while!"

Technique D-6 in Section XXI (Appendix 1, page 83) was intended to serve the purpose of correcting the trainee's tendency inadvertently to use aileron as he pulled the stick back in stalls. This technique was rated "D" by 20 judges, "A" by 14, and "D" by 4. The suggested procedure was to "Have the trainee spend one-half hour or so in a plane on the ground and practice coming straight back on the stick while watching the ailerons to see that they don't move." Comments made by judges classifying this technique as "Bad and should not be used" were "This is of no practical value," "He doesn't watch aileron while in flight," "Not necessary," and "Makes student look and feel foolish. Should not make example of student in front of others."

Another example of a technique which obtained a relatively large number of "D" classifications, but which nevertheless was eliminated is represented by technique B-3, Section XXVI (Appendix 1, page 97). This technique, which was rated "D" by 20 judges, "C" by 11, "A" by 5, and "E" by 4, recommended that in situations where the trainee found difficulty in determining the height above the ground at which to level off, the instructor should "Fly across the field at low altitude, but at various heights, instructing the trainee to call out the different altitudes in terms of intervals of 5 feet as the height above the runway changes." Comments made on this technique include "Impossible to do, unnecessary," and "Very difficult for student and tends to take away from his actual landing practice."

The above techniques, and a few others, received a relatively great number of "D" ratings, but were eliminated because the number of "E" ratings was slightly over the maximum set in terms of the standards which were established. One of the three techniques rated "D" by between 25 and 29 judges was eliminated on the basis of four "E" ratings and four of the seven techniques rated "D" by between 20 and 24 judges were similarly eliminated.

It is not within the province of this report, however, to make an evaluation of whether such techniques actually have sufficient merit to be recommended for inclusion in the final compilation or more specifically whether or not the judges' reasons for classifying certain techniques as "Bad and should not be used" were sound. Nevertheless, as mentioned above, it must be recognized that a number of techniques may have been eliminated because of the fact that some of the judges were unsophisticated in such matters, and failed to recognize the pertinence of certain sound educational principles which actually are applicable to flight training.

On the other hand, it should be remembered that such a compilation of effective techniques as is suggested would be circulated widely in the field. It may well be that elimination of the type of technique under discussion will lead to more ready acceptance of the compilation by the great body of flight instructors than if certain techniques which carried the unpleasant connotations of "progressive education" to some of the more conservative were included.

Number of Judges Classifying Selected Techniques in the Specific Categories. The number of judges who classified each of the techniques selected for the final compilation in the "A," "C," and "D" categories is indicated in Table 4. It is evident that seven of the techniques are classified in a given category by 25 or more judges (approximately 50% of the group). Examination of Table 4 also indicates the number of techniques which would be eliminated if the standards for inclusion in the "A," "C," or "D" groups were raised. For example, if the standards for inclusion of techniques in these groups were raised so that assignment of a given classification by 15 or more judges were required, 55 of the techniques included by the present standards would be eliminated.

TABLE 4

NUMBER OF JUDGES CLASSIFYING SELECTED TECHNIQUES IN THE "A," "C," AND "D" CATEGORIES

	"A"	"C"	"D"
30-34	2		
25-29	3		2
20-24	8		3
15-19	19	1	11
10-14	36	2	17
	68	3	33

Number of Techniques in Each Section of the Original Compilation Included in the Final Compilation. In Table 5 is listed the number of techniques in each section of the original compilation which have been tentatively included in the final compilation. It is of some interest to note that in general the categories of general instructional problems or maneuvers under which the greatest number of techniques submitted for the original compilation was included also have relatively greater incidences of selected techniques in the final compilation. However, certain marked divergences from this general trend are evident. Furthermore, in preparing the final manual in which these techniques are incorporated it may prove desirable to acquire, from other sources, techniques for inclusion in those sections in which no techniques are now included. It may be that instructional areas in which only a small percentage of techniques met the evaluative standards are areas in which the number of instructional difficulties is greatest.[9]

General Considerations. It should be emphasized that the techniques in the compilation presented as Appendix 1 which are indicated as meeting the specified standards, cannot merely be lifted out of context and incorporated in a manual. The original compilation was prepared merely as a compilation in which all of the minor variants of a number of the techniques were included. It is of interest to note that when a number of variations of a given technique is presented, in several cases different versions of the procedure are evaluated differently. Compare, for example, the evaluations of techniques B-2 and C-1 in Section XV (page 68) of the compilation and technique D-3 in Section III (page 48) of the compilation. Moreover, in certain cases where various subdivisions of the same techniques were evaluated separately, all of the subdivisions were not given the same classification. See, for example, techniques 3-a, b, and c in Section XXVI (page 94) of the compilation.

In collecting the selected techniques for presentation in manual form some general editing and rearrangement of the techniques will be required. However, certain apparent anomalies in the evaluation of the techniques in the present compilation are suggestive as far as the limits of such editing and rearrangement are concerned. It was noted above that similar techniques, classified under different instructional problems, were given different evaluations by the group of judges. In one case in which under one instructional problem a cross reference was merely made to a technique included under another instructional problem on the same page, the cross reference and the complete description of the technique were evaluated differently. See techniques C-5 and D-3, Section XVII, page 73 of Appendix 1. These facts suggest that in collecting the selected techniques for presentation in manual form they should be classified under the same instructional problems in terms of which they were evaluated.

Although the recommended techniques cannot be incorporated into manual form without further editing, and although the necessity of setting stringent

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[9]The 50 instructional problems submitted by the 99 instructors who replied to the original questions represented too few to provide for a thorough analysis. It may be of some interest, however, that only two of these problems were concerned with stalls and spins, whereas 8 of them were concerned with "Coordination." See: Ewart, E., and Viteles, M. S. Preliminary analysis of replies to instructor questionnaire. Progress report. March 1944. Copy in Committee files.

TABLE 5

NUMBER OF TECHNIQUES IN EACH SECTION OF ORIGINAL COMPILATION INCLUDED IN FINAL COMPILATION

Section	Title	No. in original compil.	No. of "A" "C" and "D" techniques in final compilation	No. of suppl. techniques
PART ONE "General Techniques"				
I	Presentation of Material	17	13	0
II	Coordination	21	2	3
III	"Problem Children"	17	5	1
IV	Tenseness	4	2	0
V	Airsickness	6	3	1
VI	Instructor-Trainee Relationships	4	2	0
VII	Routine Safety or Traffic Checks	9	1	0
VIII	Instruction in Slow Flight	6	4	0
IX	Determination of When Trainee Should Solo	2	0	0
X	Standardization of Instruction	2	2	0
PART TWO "Techniques Specific to Individual Maneuvers"				
XI	Cranking Plane	2	0	0
XII	Taxiing	3	0	0
XIII	Take-off	18	5	1
XIV	Straight and Level	8	1	1
XV	Low Work	9	2	0
XVI	Eights on Pylons	7	1	3
XVII	Normal Turns	45	12	3
XVIII	Steep Turns	9	4	1
XIX	Slips	3	0	0
XX	Lazy Eights	1	1	0
XXI	Stalls	26	9	4
XXII	Spins	22	2	2
XXIII	Glides	4	2	0
XXIV	Airport Traffic Procedures	2	2	0
XXV	Approach to Landing	8	4	0
XXVI	Landings	64	16	11
XXVII	Forced Landings	6	1	0
XXVIII	Night Landings	1	0	0
XXIX	Cross-wind Landings	4	3	1
XXX	Coordination Exercise	6	2	2
XXXI	Instrument Flying	5	2	1

restrictions in regard to category "E" may have resulted in the elimination of a number of potentially good techniques, the body of techniques which has been designated represents at very least a basic group of sound procedures around which a useful manual can be built. Such a manual will meet a real need which arises from the fact that flight instructors have not, in general, had an opportunity to meet and exchange information regarding particularly effective instructional procedures which they have developed on the basis of their own instructional experience.

SUMMARY AND CONCLUSIONS

By means of a questionnaire, descriptions of instructional techniques which flight instructors in the field found useful in their day-to-day experience were collected. A compilation was made of 341 techniques submitted by 99 flight instructors who replied to the questionnaire. This compilation was then evaluated by members of the Instructor Training Corps of the Army and Navy Air Forces, and by representatives of the General Inspection Division, CAA. Each of these men through use of an "Evaluation Booklet" assigned each of the techniques in the compilation to one of five categories:

A. "Good and not used by the great majority of flight instructors."

B. "Good, but commonly known and used by nearly all flight instructors at present."

C. "Good, but must be used with extreme caution."

D. "Serves limited purpose in special situations."

E. "Bad and should not be used."

Analysis of these evaluations indicated that while considerably more techniques were rated "B" than "A" by a relatively large number of judges the majority of techniques were not classified as "E" by more than a relatively small number of judges, 190 or 56% of the techniques being classified "E" by fewer than 4 judges. Standards for selection of techniques to form the basis of a final compilation were set up. In order that the body of designated techniques could be considered as little suspect as possible, rather stringent requirements were set up in regard to the "E" category, any technique rated "Bad and should not be used" by more than 3 judges being eliminated from consideration.

Through application of these standards, 104 techniques (30% of the techniques originally submitted) were selected for inclusion in the final compilation. Of these, 3 were designated as "To be used with extreme caution," and 33 as "Serve limited purpose in special situations," whereas 68 were designated as "Aerodynamically correct and good from the viewpoint of instruction." An additional 35 techniques were designated as "Supplementary." These latter techniques met the standards for the "E" classification, and although not meeting the standards for inclusion in terms of either the "A," "C," or "D" categories considered individually were classified either as "A" or "D" by 20% or more of the group of judges. None of the designated techniques were classified as "Good but in general use" by more than approximately 75% of the judges.

APPENDIX I

EVALUATION OF INSTRUCTIONAL TECHNIQUES INCLUDED IN ORIGINAL COMPILATION

APPENDIX I

In this appendix is presented the compilation of instructional techniques submitted by 99 flight instructors who replied to the questionnaire described in the body of the report. To the left of each technique is indicated the number of judges classifying it in each of the five categories, designated as follows:

A. "Good and not used by the great majority of flight instructors."

B. "Good, but commonly known and used by nearly all flight instructors at present."

C. "Good but must be used with extreme caution."

D. "Serves limited purpose in special situations."

E. "Bad and should not be used".

The designation of the techniques in terms of the standards and procedures described in the body of the report is as follows:

1. Techniques designated as "A" are enclosed by purple boxes.

2. Techniques designated as "C" are enclosed by red boxes.

3. Techniques designated as "D" are enclosed by green boxes.

4. Techniques designated as "supplementary" are enclosed by purple broken lines

A number in parenthesis following a technique in the compilation indicates the number of different instructors submitting the technique in question.

OUTLINE OF SECTIONS

Part One

I. Presentation of Material
II. Coordination
III. "Problem Children"
IV. Trainee Tenseness
V. Airsickness
VI. Instructor-Trainee Relationships
VII. Routine Safety or Traffic Checks
VIII. Instruction in Slow Flight
IX. Determination of when Trainee Should Solo
X. Standardization of Instruction

Part Two

XI. Cranking Plane
XII. Taxiing
XIII. Take-off
XIV. Straight and Level
XV. Low Work
XVI. Eights on Pylons
XVII. Normal Turns
XVIII. Steep Turns
XIX. Slips
XX. Lazy Eights
XXI. Stalls
XXII. Spins
XXIII. Glides
XXIV. Airport Traffic Procedures
XXV. Approach to Landings
XXVI. Landings
XXVII. Forced Landings
XXVIII. Night Landings
XXIX. Crosswind Landings
XXX. Coordination Exercises
XXXI. Instrument Flight

PART ONE

GENERAL TECHNIQUES

Techniques in Part One are applicable to instruction in a number of maneuvers.

COMPILATION OF INSTRUCTIONAL TECHNIQUES

I. PRESENTATION OF MATERIAL

One of the first training problems confronting the flight instructor is the presentation of material to the trainee in an organized manner. The following techniques along this line have been suggested:

Training problem	A	B	C	D	E	Omit	Technique
A. Adequate ground instruction.	12	36	0	0	0	1	1. At the start of the training period, and at frequent intervals, be certain that all trainees are given group lectures and participate in group discussions to assure that all material is covered.
	18	19	6	4	0	2	2. In individual ground discussions before each flight, give thorough explanations of the aerodynamic principles involved in the maneuvers to be taken up so that the trainee will have a thorough understanding of what he will be trying to do and why.
	10	36	0	1	0	2	3. In explaining maneuvers on the ground, make comparisons with things the trainee is already able to do, such as driving a car. For instance in teaching throttle-elevator coordination, compare the use of the throttle to the use of the accelerator in a car when going up hill, when going down hill, and when traveling on a level road. Ask the question, "Can you go up hill in your car without stepping on the accelerator?"
	17	12	1	16	1	2	4. Instruct trainee to keep a notebook in which is sketched down each day, every detail of the flight, and the instructor's comments. The notebooks should be checked daily by the instructor.
	19	17	1	6	2	4	a. All maneuvers should be diagramed and all of the instructor's comments should be summarized.
	27	12	1	10	1	3	b. A specific section should be set aside for a "diary" of each flight, including a record of the errors made, the instructor's suggestions as to how to correct them, etc.
	2[illegible]	[illegible]	0	10	0	3	c. An outline of the next lesson should be given to the trainee by the instructor and should be included in the notebook.

Training problem A	B	C	D	E	Omit	Technique
						5. Following solo practice, spend at least 30 minutes with trainee on ground at end of flight, answering all his questions.
30	6	0	11	1	1	
7	41	0	0	0	1	
						B. Demonstration and explanation in the air.
						1. Give thorough demonstration before trainee attempts maneuver.
						2. If trainee fails to understand demonstration, break the maneuver down on subsequent demonstrations and demonstrate its component parts.
14	30	2	2	1	0	
7	18	4	13	4	3	3. While demonstrating, don't talk too much.
						4. On the trainee's first few trials on a new maneuver, talk him through it, giving a "play-by-play" description of the operations of the controls. In giving the recovery from a turn, for instance, state: "Now use top rudder, aileron, and release back pressure and recover to level flight, and retard the throttle to cruising."
6	15	2	10	15	1	
						C. Directing trainee practice.
						1. After thorough explanation on ground, take one maneuver at a time and following demonstration, help trainee through the maneuver 4 or 5 times and then let him iron out his own mistakes for a while. It will just come to him in time. (This procedure, according to the contributing instructor, is particularly applicable to instruction in acrobatics.)
2	21	7	13	4	2	
24	24	0	0	0	1	2. Teach the trainee to think about his performance and to analyze it. (3)
						a. Have the trainee talk to himself, telling himself how he is using the controls, what reference points or landmarks he is using, etc.
18	6	3	18	2	2	
						b. Have the trainee talk to you as if he were the instructor and you the trainee, explaining as he goes along just what, when, and where he is going to change the attitude of the airplane, and why he plans to do it, what he is going to do next, where the wind is, etc. This technique aids the instructor in correcting many mistakes before they happen. (See also technique 2, Sec. XXVI, N.)
31	4	5	5	3	1	
						c. When a mistake is made, instead of telling the trainee what he did wrong, ask the trainee to tell you.
28	11	3	4	1	2	

II. COORDINATION

The following techniques have been suggested to meet the problem of explaining coordination and to correct trainee errors in the proper use of the controls. Other techniques referring to specific maneuvers will be found in Part Two, particularly under Section XVII Turns.

Training problem	A	B	C	D	E	Omit	Technique
A. Introduction of trainee to correct methods of coordinating controls.							1. On second flight, give brief explanation of coordination, followed by demonstration. Never go into detailed explanation on the ground until the trainee has seen in flight what he is supposed to do. After demonstration, let trainee try coordinating rudder and aileron and then thoroughly explain what coordination is.
	5	24	1	10	5	4	On third or fourth flight, and never later than the fifth, take the controls and demonstrate a bad slip and a bad skid. Then whenever trainee slips or skids, quiz him until sure that he knows what error has been made, can explain why he made the mistake, and can tell how to correct it. Have the trainee practice coordination exercises at least once every flight after the first one. In the later stages of training, never let a slip or skid go by without correction, no matter how minute the error.
	5	39	2	0	2	1	2. Teach trainee at start the idea of control pressures as contrasted to movements.
	1	13	3	19	12	1	3. After demonstrating proper coordination, have trainee make turns handling rudder only, instructor handling stick. Then have trainee make turns handling stick only, instructor handling rudder.
B. Trainee consistently uses too little rudder.	8	15	5	10	10	1	1. Place emphasis on the rudder right from the beginning with as little as possible said about the stick. The stick is handy to use and they'll use it. If anything is slighted the rudder will be.
	5	3	8	19	12	2	2. Have trainee hold the stick and convince himself that the instructor is not using any aileron. Then take off, flying the traffic pattern, and land using only rudder and elevator. This technique may cause trainee to overdo the rudder, but it's usually much easier to get him off the rudder than to get him on it.

Training problem						Technique
A	B	C	D	E	Omit	
						3. Hold stick firmly and solidly in neutral position and require trainee to fly keeping wings level with rudder correction alone. After trainee has proved to himself that this is possible, explain the control functions to him again, and have him blend the two together. (See also Technique 2 under Sec. XXVII, D.)
6	16	3	10	8	6	
3	44	1	0	1	0	
C. Trainee overcontrols aileron and rudder.						1. Show the trainee how the plane will do a better job of flying than he can. (4)
6	41	0	0	0	2	a. Demonstrate how the plane will fly hands-off in smooth air -- convince him that brute strength is not necessary.
7	36	2	2	0	2	b. Demonstrate how the plane will fly hands-off in rough air and that it is not necessary to do something about every movement of the plane.
1	45	0	1	0	2	2. Show the trainee that only light pressures are necessary. (3)
7	29	3	6	1	3	a. Have the trainee hold the stick with two fingers and place only the toes of his feet on the rudder.
12	29	3	4	0	1	b. Have trainee lay finger on top of control stick and notice how slightest amount of pressure changes attitude of plane.
7	8	7	11	11	5	3. Tell the trainee to move the controls as if they were caught in thick "gooey" molasses.
9	27	3	6	2	2	4. Demonstrate and have the trainee perform the maneuvers extremely slowly (refers to speed of execution, not airspeed).
1	1	7	11	27	2	5. Each time the trainee starts to make a turn (or other maneuver) push on the controls without his suspecting that you are going to do so, until it becomes apparent to him that each time he executes a maneuver, the execution will be violent unless his pressures of movements of the controls are lessened.
2	3	6	7	28	3	6. Fly trainee in rough air, riding all controls to make them extra heavy. Follow this by session of flying hands-off.
11	28	0	7	1	2	7. Give lots of confidence maneuvers.

Training problem	A	B	C	D	E	Omit	Technique
D. Trainee has poor throttle-elevator coordination.	9	32	2	3	0	3	1. Have trainee fly straight and level without changing pressure on the stick. Then increase and decrease the throttle setting, noting the differences in attitude and the change in altimeter.
E. Trainee is convinced that he has poor coordination and that nothing can be done about it.	21	5	1	11	8	3	1. Have trainee drive an automobile down a road. Then point out that high degree of coordination he showed in pushing in the clutch with the left foot, operating gear lever with right hand, etc., and at the same time driving on the right side of the road, looking for other cars, etc. Explain that his coordination on that job is just as complex as that required while flying and that it is just a question of practice and learning proper habits.
F. Demonstration to trainees of errors in coordination.	7	32	5	2	0	3	1. Make demonstration of the maneuvers in question greatly exaggerated, both in terms of exaggerating errors made by trainee so that effect of these errors is clearly apparent, and in terms of exaggerations of correct timing, frequently using movement instead of pressures. Exaggeration of correct execution should be clearly and specifically pointed out to the trainee, however. (3)
	3	20	8	4	8	6	2. Signal the trainee when he is making errors in control application by tapping the controls in the direction that the correction should take place. For example, if he needs a little more right rudder pressure, tap the right rudder lightly with your toe. But, be certain that the trainee is informed beforehand of the nature of the signal.

III. "PROBLEM CHILDREN"

Flight instructors are frequently puzzled by trainees who can best be characterized as "problem children." Such trainees may develop peculiar habits, they may be convinced they cannot execute certain maneuvers, they may consistently forget to use certain controls, or forget certain parts of a sequence of maneuvers. Following are techniques which some instructors have found of practical value in dealing with certain of these problems. Other similar techniques which apply to specific maneuvers will be found in Part Two, classified under the particular maneuver involved.

Training problem		Technique
	A B C D E Omit	
A. Trainee's performance on given lesson poor.	19 24 2 3 1 0	1. If trainee is not progressing satisfactorily after reasonable length of time, bring him back to the line and go over the execution of the maneuvers again on the ground. If the trainee cannot explain the maneuver on the ground, don't expect him to perform it in the air.
B. Trainee cannot incorporate fundamentals into new maneuver.	6 0 1 23 18 1	1. Write a rather long story in the first person, describing the execution of every maneuver in the sequence that is causing difficulty. Make the trainee memorize it. Then have him relate the story to you (the instructor) while he flies through the sequence in the air.
	5 41 2 1 0 0	
C. Trainee is convinced that he can't do certain maneuvers because they are "tough."		1. Make clear that each maneuver is "just another maneuver" which any average individual can execute after sufficient study and practice.
D. Trainee cannot visualize ground pattern.	16 9 0 17 7 0	1. Have trainee draw pattern on ground to a rather large scale. Then have trainee take a staff about five feet long in both hands, and while imitating bank and crab angles, walk over the ground pattern. At the same time, have the trainee describe what degree of bank he should use and how he would vary the bank to follow the pattern and why. (See also Technique 2, Section XV, D.)
E. Trainee loses orientation in climbs and high work.	7 41 0 0 1 0	1. Trainee may be concentrating so hard on certain elements of precision that he may forget to look at the ground below at all. Instruct him to orient himself after each climbing turn or after each stall or other maneuver he is doing.

Training problem		Technique
	A B C D E Omit	
F. Trainee is ground-shy.	3 29 8 7 2 0	1. Do lots of emergencies and drag areas to build up confidence.
G. Trainee is afraid of heavy traffic.	8 3 10 15 13 0	1. Give trainee a taste of formation flying -- have two instructors fly to the rear and in close formation with trainee flying the lead. Then occasionally change places in the formation.
H. Trainee blames poor execution of maneuvers on the plane.	15 9 3 13 9 0	1. Tell the trainee: "There are three of us up here, you, I, and the plane. The plane has no brains. I have, and you have, I hope. You're flying, I'm riding. So let's see <u>you</u> fly the plane." Later, if the trainee makes the same excuse, just ask: "Who's flying?"
I. Trainee forgets same things over and over again.	6 9 3 19 11 1	1. Make the trainee write the name of the operation he forgot fifty times and give him to understand that the procedure will be repeated every time he forgets.
J. Trainee forgets to keep hand on throttle.	3 2 3 3 35 3	1. Tie the trainee's left hand to the throttle and keep it tied there throughout one lesson period.
K. Trainee forgets to use trim-tab.	5 41 0 1 1 1	1. Explain that the trim-tab is a labor-saving device and that he won't have to work so hard if he makes use of it.
L. Trainee appears extremely slow or "hopeless."	24 23 1 1 0 0	1. Look for other factors outside of flying that might influence his performance, e.g., physical and mental condition, girl trouble, excessive drinking, etc.
	11 26 3 4 3 2	2. Space lessons to not more than one per half-day.
	7 18 4 15 4 1	3. Give practice in slow flight. (See also Technique in Section VIII.)
	7 29 4 6 1 1	4. If instructor or check pilot cannot find out what is wrong, transfer trainee to other instructor.
	11 37 0 0 0 1	5. Trainee may think that certain of his performances which are wrong actually represent the correct manner of execution of a maneuver, e.g., that rudder must be held as long as plane is turning. Examine trainee's performance carefully to determine if he has any such misconceptions and if he has, correct them.

Training problem						Technique
A	B	C	D	E	Omit	
15	24	1	6	0	3	6. Increase trainee's confidence by giving confidence maneuvers, practice in slow flight (see Section VIII), improving your personal relations with trainee (see Section VI) decreasing tenseness (see Section IV), etc.*

*Techniques designed to increase the trainee's confidence in his ability to perform specific maneuvers will be found in Part Two classified under the particular maneuver in question.

IV. TRAINEE TENSENESS

The tendency of trainees to be tense is one of the most troublesome problems facing the flight instructor. Studies have shown that different instructors often don't even agree on what they mean when they say that a trainee is "tense," some referring to "mental" as well as "muscular" tenseness. Following are a number of techniques which refer primarily to reduction of "muscular" tension. Other techniques designed to combat airsickness, to increase the trainee's confidence, etc., also undoubtedly reduce tenseness. These techniques, however, are classified under different headings.

Training problem	A	B	C	D	E	Omit	Technique
A. Tenseness leads to rough control use.	4	31	1	6	5	2	1. Since tenseness usually first shows up in the trainee's legs, affecting his rudder action, tell trainee to relax his legs.
	19	20	0	6	1	3	2. Give trainee review of former work, or something he is more familiar with, such as driving a car, playing ball, playing a musical instrument, or calling his girl friend. (See Technique 1, Section II, F.) Show him how he is at ease in those situations, and compare them with his feeling at ease while flying.
	19	28	1	0	0	1	3. Be friendly with the trainee rather than have him hold you in awe and feel that you will wash him out at the least possible excuse. (2)
B. Trainee tense in stalls and spins, and other violent maneuvers.	10	2	2	21	10	4	1. Demonstrate, or have the trainee do a mild stall -- not a complete stall, but push the stick far enough forward so that there is a sensation of not sitting on the seat. While the plane is coming up into the unusual climb position, tell the trainee "expel all air from your lungs down to the bottom of your toes." Then as the plane dips down say: "Take a deep breath." At the completion of the maneuver ask, "Did you feel any particular sensation?" The trainee will always answer "Yes." Then repeat the maneuver, this time instructing the trainee in a different breathing procedure. As the plane comes up to the top of the climb position ask the trainee to take a full deep breath of air. As the plane goes down ask him to expel all air. When asked if he felt any peculiar sensation the trainee will answer "No." By repeated demonstration, show the trainee that relaxation in this maneuver can be aided by proper breathing.

V. AIRSICKNESS

The following techniques have been suggested to deal with the tendency of trainees to get airsick.

Training problem						Technique
A	B	C	D	E	Omit	
11	37	0	0	1	0	1. Anticipate such condition by noting early symptoms such as control technique, color of skin, perspiration, response to instruction, or other indicators peculiar to the individual. When indications are present, either return to field or practice maneuvers which are not violent.
9	34	0	5	0	1	2. Determine the maneuvers which result in airsickness in particular trainees. Then avoid those maneuvers if indications of airsickness are present or build up to those maneuvers and introduce them gradually.
0	3	0	15	29	2	3. Say to trainee: "Okay son, I'll take over while you hang your head out the window and get rid of it, then get back to flying this thing yourself."
20	20	0	7	0	2	4. Keep the trainee interested so that he won't have time to think about getting airsick. (3)
12	27	3	4	1	2	a. With yourself, or preferably the trainee flying the plane, carry on a conversation, pointing out various objects on the ground or asking the trainee to look for some particular object himself, discussing the matter with him while he hunts.
10	4	4	18	10	3	b. Frame up with another instructor who has a more advanced trainee. Follow him out to his practice area and have your trainee watch him closely while he does simple acrobatics for a few minutes. After a little of this, duplicate some of the other fellow's more simple acrobatics and then take the trainee back to the airport before he has time to think about getting sick. Then tell him in all seriousness what a rough ride it was and how anybody who can go through that need never worry any more about getting airsick.

VI. INSTRUCTOR-TRAINEE RELATIONSHIPS

There is little question but that the instructor occupies a position of considerable prestige. There is a problem involved, however, in the most effective use of this prestige so that the trainee respects the instructor, but is not afraid of him or antagonistic toward him. A number of techniques have been proposed to improve instructor-trainee relationships.

Training problem	A	B	C	D	E	Omit	Technique
A. Improvement of instructor-trainee relationships.	13	4	5	19	5	3	
	29	20	0	0	0	0	1. Try to correspond with former trainees and when one writes and thanks you for some specific thing you have stressed, show the letter to your present trainees. The particular point involved will be stamped on their minds and they will have more respect for other suggestions you make to them.
	20	29	0	0	0	0	2. Always try to put yourself in the trainee's place and realize that just because you demonstrate the maneuver expertly is no reason for believing that the trainee has understood your explanation of it.
	12	15	10	8	4	0	3. Win the confidence of the trainee and try to analyze his problems.
							4. Make some of the flight lessons a game by betting the trainee a coca-cola on the excellence of his execution and his accuracy on certain maneuvers. (See also Technique 2, Section XXVII, C.)

VIII. ROUTINE SAFETY OR TRAFFIC CHECKS

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee forgets to check gas shut-off valve before take-off.							1. If flying is being done off of a long field, and the instructor knows exactly how long motor will run after the valve is turned off, the instructor should shut off the gas shut-off valve while trainee is testing mags. If the plane just gets off the ground and the motor quits, the trainee will never again forget to check this valve.
	5	2	14	4	23	1	
	11	14	2	12	9	1	
B. Trainee forgets to check traffic before executing maneuvers.							1. Hold the stick firmly before each maneuver until the trainee has cleared himself all around.
	5	14	5	16	7	2	2. Sit in the rear cockpit for several periods and never let the trainee go longer than 20 seconds without looking around and clearing himself completely.
	8	3	5	16	14	3	3. Force trainee to fly for one entire period <u>without</u> looking around, depending entirely upon the instructor. The instructor should merely tell the student that it is clear to make a turn (or maneuver) or that it isn't, but should never explain and tell him what is happening. Every time the trainee feels impelled to "sneak a peek" the necessity of checking traffic will be brought home to him.
	4	9	8	16	10	2	4. Create the impression that because the trainee failed to clear himself, he almost caused an accident. (2)
	6	4	2	19	15	3	a. Watch trainee closely in mirror (in planes in which instructor sits in front of trainee), and when he starts a maneuver without clearing properly, suddenly look around sharply as if you were watching another plane. Almost invariably the trainee will stop the turn and look sharply in the same direction. Then a loud laugh on the part of the instructor drives the point home.
	2	1	7	14	24	1	b. When trainee turns without clearing properly, suddenly grab the stick and make a diving turn. Then after leveling off, give the trainee hell and tell him that he almost hit a B-26 (or other plane, depend-

Training problem A B C D E Omit	Technique
	ing on conditions). (The instructor suggesting this method stated that the trainee he used it on never failed to clear again and is not sure to this day whether or not the instructor was fooling.
13 24 2 6 1 3	5. Cause the trainee to be actively interested in what he will see if he does look around and at the same time avoid making him apprehensive about looking around. That is, the instructor should look around in a manner that indicates that he is really interested and if necessary he should even simulate a certain amount of alarm.
C. Trainee forgets to fasten safety belt. 1 8 6 13 19 2	1. If flying a closed plane, pull the nose of the plane up and then go forward sharply on the stick so that the trainee's head is pressed up sharply against the top of the plane. Then explain what would happen to him if he were in an open plane.

VIII. INSTRUCTION IN SLOW FLIGHT

A number of instructors have indicated that in their experience, the use of slow flight, i.e., training periods in which the plane is flown at a speed just above stalling, has proved effective in teaching stall recognition and in improving coordination. The following types of practice at slow speed have been suggested:

Training problem						Technique
	A	B	C	D	E	Omit	
1.	11	36	0	1	0	1	Take trainee to a safe altitude and have him fly the plane as slowly as possible without actually stalling it.
2.	8	28	1	5	5	2	Reduce power to about 1500 rpm (in a light plane) and have the trainee exert sufficient back pressure so that altitude is maintained. Have trainee experiment with the effect of aileron, rudder, and elevator on flight in this condition. Require that trainee make full 360° turn using rudder alone. Continue instruction until trainee is thoroughly familiar with the effects of the controls at stalling speed.
3.	6	24	5	10	3	1	Practice slow flight at 100 rpm above cruising with the plane hanging just above stalling speed. Practice turns with various degrees of bank and complete the demonstration by having the trainee make a steep turn and stall the turn out, recovering from the spin.
4.	10	35	2	0	1	1	Fly nose high, maintaining constant altitude by varying throttle setting. Follow with a series of 90° turns (in slow flight) as steep as trainee can do well, rolling from bank to bank without returning to continuous straight and level.
5.	7	35	5	1	0	1	Practice landing stalls from slow flight. (See Section XXI.)
6.	14	20	4	10	0	1	By reducing rpm slightly and adjusting the stabilizer nose light a plane can be kept at fairly constant altitude at gliding speed. If "S-turns" and coordination exercises are now carried out, the control pressures are identical to those in a glide and valuable altitude is not lost. Also since greater control movements are required to obtain reactions from the controls than at cruising speed, a trainee is given a better opportunity to observe the effect of his pressures. This is valuable as his errors in coordination are more easily perceived by both himself and the instructor. Furthermore should the airspeed fall below that of a normal glide, the feel of mushing can be pointed out and be made familiar to the trainee.

IX. DETERMINATION OF WHEN TRAINEE SHOULD SOLO

Training problem						Technique
A	B	C	D	E	Omit	
9	8	5	15	11	1	1. Have the trainee talk to you throughout the entire landing -- telling a joke, preferably, or anything he wants to talk about except the airplane. If he can talk throughout and make a good landing it indicates that he is relaxed enough to solo and will not do anything foolish on his initial solo around the field.
1	41	2	1	4	0	2. A trainee should be soloed when he knows what he wants to do and has sufficient skill to execute consistently safe take-offs and landings even if somewhat rough and particularly, if he can demonstrate prompt recoveries from rough landings. Trainees who cannot learn to handle the controls smoothly or who are erratic should not be soloed.

X. STANDARDIZATION OF INSTRUCTION

The following techniques have been suggested to aid in standardizing instruction.

Training problem						Technique
	A	B	C	D	E	Omit	
1.	13	34	1	1	0	0	The chief pilot should see that frequent check rides are given not only to the trainees, but also to the instructors.
2.	12	35	1	0	0	1	Have frequent pilot meetings so that all instructors are teaching the same maneuvers and with the same manner of execution.

PART TWO

TECHNIQUES SPECIFIC TO INDIVIDUAL MANEUVERS

The techniques in Part Two are specific to individual maneuvers.

XI. CRANKING PLANE

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee stands too far from plane when cranking it.	5	33	2	2	6	1	1. Instruct trainee to stand close enough so that the tips of his shoes are directly under the edge of the propeller. Then, when pulling the propeller through, instruct him to pull <u>down</u> and <u>away</u>. Thus he will not be off balance, forward, toward the spinning propeller.
B. Trainee is careless while cranking plane.	3	46	0	0	0	0	1. Instruct trainee always to pull propeller through on the assumption that the ignition is on, even if it is not supposed to be.

XII. TAXIING

Additional instructional techniques for "taxiing" will be found in Sections XIII and XXVI in connection with the take-off and landing runs.

Training problem		Technique
A B C D E Omit		
A. Trainee has difficulty controlling plane while taxiing.		
1 7 10 16 14 1	1.	Have trainee practice taxiing fast at 1200-1500 rpm.
0 11 14 15 6 3	2.	Have trainee stretch the landing run by putting on a little power after landing and letting the plane roll the length of the field.
B. Trainee attempts to turn plane with wheel.		
1 14 6 14 12 2	1.	The instructor should hold his dual control wheel while taxiing so that it cannot move.

XIII. TAKE-OFF

Training problem						Technique
	A	B	C	D	E	Omit	
A. Procedure for introducing take-off.	7	18	3	16	3	2	1. Break the actual take-off into several phases: (1) have trainee use rudders alone until he has learned to keep the plane straight down the runway, (2) have trainee use rudder and throttle, (3) have trainee use rudder, throttle, and stick.
							2. Choose a calm day when you can take off directly into what wind there is. Instruct trainee that he is to handle <u>the stick only</u> on the first take-off. Center the stick, visually checking the position of aileron and elevators. Instruct the trainee that he is to <u>make no movement whatsoever</u> of the stick, but merely to hold it in the center position, and that you (the instructor) will take care of the rudder. Trim the stabilizer just slightly nose down. Instruct the trainee to open the throttle in one smooth motion -- a little bit fast if anything. The airplane will leave the ground in a shallow climb position and after becoming airborne, instruct trainee to take over all controls as usual.
	7	10	4	15	10	3	Before the next take-off, review the effect of torque and the proper use of rudder correction. Line the plane up on the runway with the nose slightly to the <u>left</u> but with the fuselage on the wind-line. Have him apply a light pressure on the right rudder and instruct him to <u>hold that rudder pressure constant</u>, and to hold the stick in the center position as on the first take-off. Then repeat the first take-off. The plane will move slightly to the left then definitely to the right and will take off very nearly lined up with the runway.
							Following this demonstration which convinces the trainee that take-off is not a very difficult maneuver, just instruct him in the adding and taking off of pressures in the normal take-off.
B. Trainee does not recognize effect of torque.	15	27	0	4	2	1	1. Fly at a safe altitude and at a slow speed. Line the plane up with some prominent landmark. Then without touching the rudder open the throttle as you would on the take-off, and point out to the trainee how the nose veers away from the landmark.

Training problem	A	B	C	D	E	Omit	Technique
C. Trainee's rudder control on take-off poor.	1	32	5	7	3	1	1. Instruct trainee to keep stick back of neutral and to hold tail of plane on ground until plane is moving fast enough for rudder to be effective.
	0	15	1	18	14	1	2. Explain to trainee that the reason finished pilots are able to keep the plane straight on take-off is that their ankles are so relaxed that if the plane turns to the left pressure of the right rudder pedal against the foot is felt at once. Explain why increased resistance of controls is an indication that more pressure should be exerted on them.
	9	34	1	3	1	1	3. Let trainee do all or most of the taxiing from the first lesson on and have him on the rudder from the second take-off in order to get him used to holding the plane straight. (3)
	6	25	9	5	4	0	4. Demonstrate to the trainee the full effect of kicking rudder on take-off, showing him that it is not necessary to kick full rudder in making corrections.
	0	2	2	11	33	1	5. Teach trainee to "fan the tail," using abrupt short movements of the rudder.
	0	5	6	15	21	2	6. When plane veers on take-off, have trainee slow it down until it is going straight.
	1	2	2	16	25	2	7. Have trainee stiffen his legs slightly with his feet on rudder to prevent overcontrolling on take-off.
	2	7	3	27	8	2	8. Put hands on trainee's feet and help him apply proper rudder pressure if necessary (in tandem planes). (2)
	3	15	4	23	3	0	9. Have trainee handle rudder only. (2)
	15	14	6	10	3	1	10. Explain the effect of torque and the use of rudder in correcting for it. Taxi to a portion of the field or a runway that is not being used. Direct the trainee to open the throttle as for take-off, and place the plane in the correct take-off position. Then the instructor should retard the throttle, then open it, then retard it again, letting the tail of the plane rise and drop alternately, the trainee keeping the plane straight for the length of the field. After reaching the end of the field, turn around and come back again in the opposite direction. (4).

Training problem	A	B	C	D	E	Omit	Technique
	8	18	4	14	2	3	a. In the beginning of the practice outlined above, it is sometimes advisable to have the trainee handle the rudder only, instructor handling the throttle and stick. (3)
	2	21	4	10	10	2	11. Stress the fact that if plane goes to right, one should merely ease off the right rudder pressure and let the torque straighten the plane out rather than to apply left rudder.
D. Trainee does not recognize that plane swerves during take-off or fails to use proper landmarks to keep plane straight.	6	41	1	1	0	0	1. Have trainee line plane up with, and sight some prominent landmark ahead and in the direction of the take-off, and keep plane headed toward it. Make analogy with sighting a gun, pointing out that he must look not at the sights (the nose of the plane) but over the nose at the landmark at which he is aiming. (2)
	7	14	13	7	4	4	2. Take off as close to the left edge of runway as possible, thus making the plane's tendency to turn to the left more evident.
	3	42	0	2	1	1	3. After taking off, instruct trainee to look behind him at the runway, to be certain he is lined up with it before making a 90° turn, thereby checking on whether or not he has maintained direction after leaving the ground.

IX STRAIGHT AND LEVEL

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee overcontrols in gusty air.	2	16	3	21	6	1	1. Have trainee practice correcting for bumps with rudder alone.
B. Trainee fails to maintain altitude.	3	6	5	22	11	2	1. Roll stabilizer to full nose-high position, and require trainee to hold altitude while flying straight and level using forward pressure on the controls. (2)
	1	16	3	20	7	2	2. Tell trainee to keep dashboard lined up with horizon and to keep wing-tips parallel with horizon.
	1	9	3	11	22	3	3. Stress the necessity of the trainee's checking on the altimeter every five seconds.
C. Trainee exhibits poor drift correction.	5	34	2	7	0	1	1. Teach trainee to fly a range, i.e., to keep two objects in line of flight "lined up."
	29	7	4	6	1	2	2. To impress a trainee with the difference between track and heading, use a spring-driven toy running across a sheet of celluloid or cellophane laid on top of a chart or table, the transparent sheet representing the air mass, and the chart the ground. By pulling the cellophane one can simulate gentle or strong winds from any direction and most convincingly demonstrate the difference between track through the air and track over the ground.
D. Trainee flies with one wing low.	4	12	6	19	6	2	1. Instruct trainee deliberately to fly with the opposite wing low for a period of time.
	3	8	3	21	10	4	2. Instruct trainee deliberately to fly with the "low" wing markedly low for a period of time.

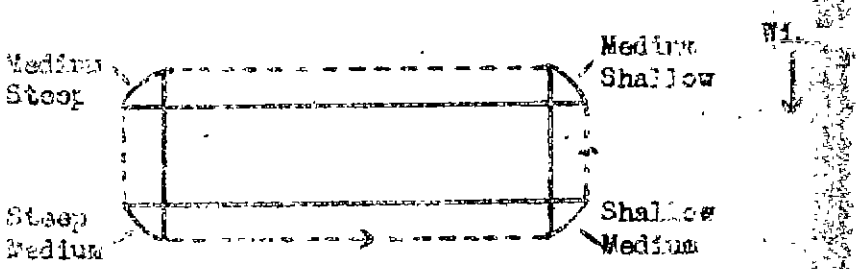
XV. LOW WORK

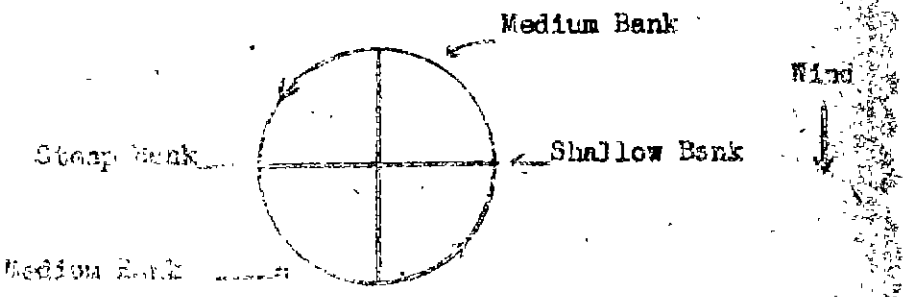
Training problem	A	B	C	D	E	Omit
A. Trainee fails to understand relationships between low work maneuvers in terms of drift correction.	13	21	0	6	8	1

Technique

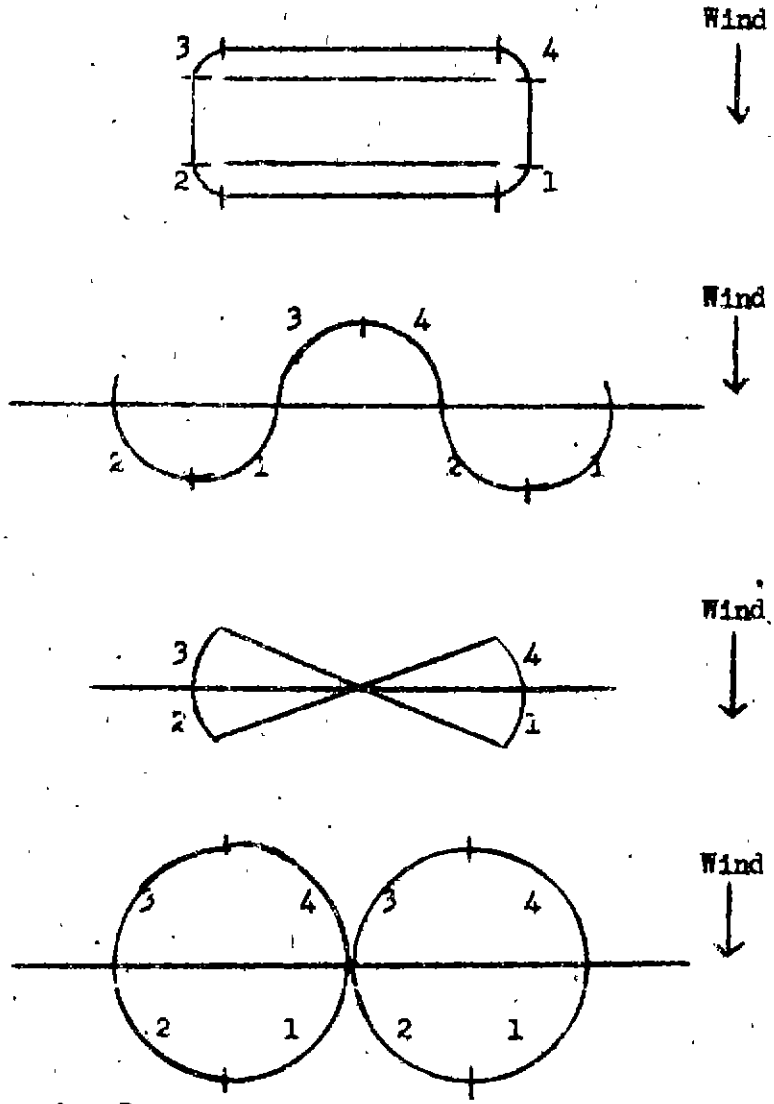
1. Make the point clear that as the ground speed increases, the degree of bank must be increased in order to hold a constant radius around a point on the ground. Illustrate the point by making a sketch of a pylon and a 360° circular path around it. Ask the trainee to imagine conditions of no wind, and to visualize a cub flying this path with a bank of 30°. Then tell him to suppose that a P-40 is flying the path with the same radius, and ask the trainee: "What would the P-40's degree of bank have to be in relation to the cub?" Then show the relation between this example and a plane flying the circular ground path with constant airspeed but varying ground speed due to wind drift.

Then draw from the trainee the fact that the greatest ground speed is in the downwind position, the slowest ground speed when the plane is flying up-wind and show how the ground speed varies at various points on the pattern, using a practical example. Show by means of diagrams how this principle applies to flying eights around pylons, S turns, and rectangular course. (2)





Training problem						Technique
A	B	C	D	E	Omit	
						2. Stress the method of correcting for drift while flying rectangular course, and by means of diagrams, demonstrate how these principles are applied to other low work maneuvers.
6	39	0	1	0	3	



B. Trainee forgets sequence on flight path for low work maneuvers.						1. Draw out sequence on paper, using a different colored pencil for each maneuver. Have trainee copy in notebook and learn to draw from memory. If trainee still cannot follow sequence, bring in and give more paper work.
8	24	2	6	6	3	

Training problem						Technique
A	B	C	D	E	Omit	
8	14	1	25	0	1	2. Take trainee to hangar floor, laid off in squares, and have him walk through the maneuvers, stating beforehand the wind direction, and using his arms to show the degree of bank at various positions. (See also Technique 1, Section III, D.)
C. Trainee consistently enters pylons upwind rather than downwind.						
6	11	3	18	10	1	1. Have trainee go into ready room and place two chairs about 10 feet apart, and then announce that he is going to fly pylon eights. Instruct the trainee to state the wind direction, and then stretching his arms wide, "fly" around the chairs.
D. Trainee fails to alter bank to correct for drift in elementary 8's.						
7	21	3	9	8	1	1. On downwind leg of flight as eight is started notice where outer wing tip appears to pivot on reference line, road, etc. This will generally mark the center of the circle and the plane should be flown around this so-called center or pylon with an endeavor to keep an equal distance away from the pylon all the way around.
5	37	2	4	1	0	
E. Trainee needs more practice in drift correction.						1. Have trainee make several circuits of each pylon in flying around pylon eights. (See also Technique 2, Section XVI, B.)
5	25	1	12	4	2	2. Have trainee make two or more S turns, making loops on one turn one size, on next turn a different size, etc.
F. Trainee unable to divide attention between plane and pylon in flying 8's around pylons.						
10	29	2	7	1	0	1. Take pilot back to variation of elementary 8's, flying figure-8 pattern without regard to pylon, telling him to try to concentrate on wing-tips of plane as much as possible, watching the instruments just enough to maintain altitude. Give frequent encouragement and praise, and gradually ease trainee over to the situation of using pylons as centers of loops of eight.

XVI. EIGHTS ON PYLONS

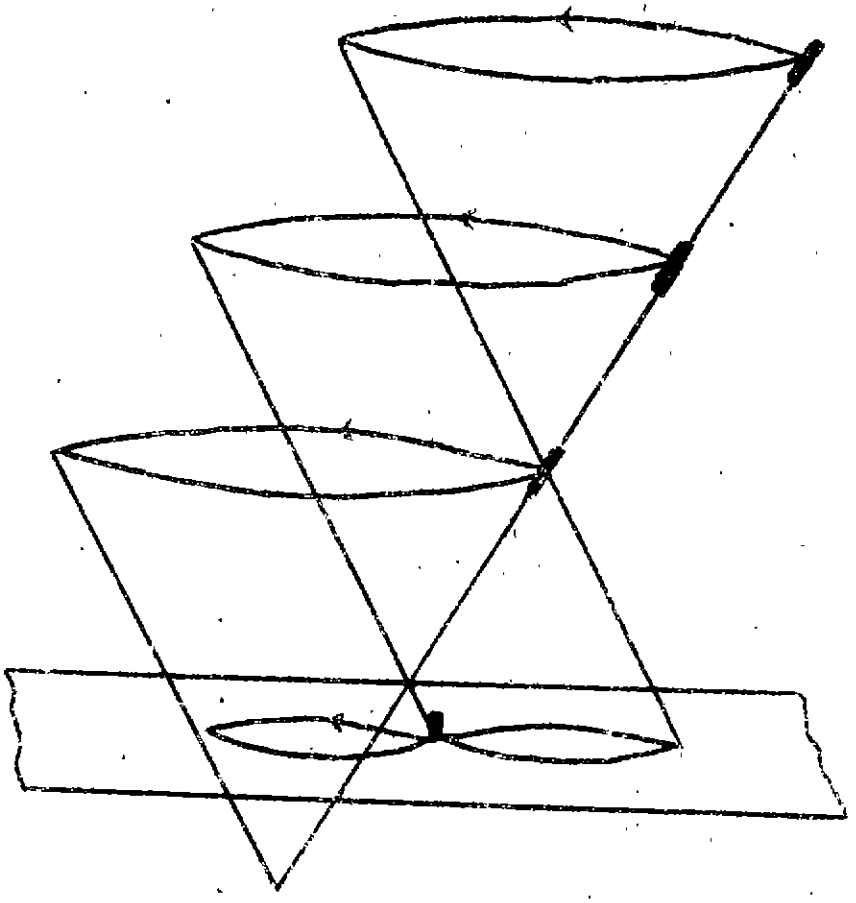
Training problem	A	B	C	D	E	Omit
A. Trainee has difficulty determining pivotal altitude.	6	25	6	5	6	1
	8	29	0	8	4	0
	7	34	3	3	1	1

Technique

1. Instruct trainee that if he can hold his pylon by using top rudder, the altitude is too high. If he can hold the pylon by using bottom rudder, the altitude is too low. The pivotal altitude is where no rudder at all is needed to hold the pylon.

2. Instruct the trainee to start at an altitude that is definitely too high and then let down until he hits the correct altitude. Then tell him to let down <u>below</u> the correct altitude and then to climb back up.

3. Have trainee find what he thinks is the pivotal altitude. If the wing moves ahead of or behind the pylon, steepen or shallow the bank, whichever is necessary. Then if the wing again moves off the pylon he can assume that he doesn't have the pivotal altitude. However, he should not change altitude the instant the wing first moves off the pylon, since he may have a late entry to the maneuver.



Training problem						Technique
	A	B	C	D	E	Omit	
	14	25	0	1	6	3	4. Use the diagram indicated on the preceding page to show the relative motion between wing tip and pylon at altitudes above and below the pivotal altitude and when at the pivotal altitude.
B. Trainee has difficulty altering bank properly in order to hold pylon.	9	31	0	6	3	0	1. Instruct trainee deliberately to shallow the bank too much and allow pylon to move back of the wing and then deliberately to steepen the bank too much and allow the pylon to move ahead of the wing. Then have him make these corrections smaller and smaller, until he is holding the pylon and the correct amount of variation becomes evident.
	8	33	2	5	0	1	2. On a day when the wind is light, have trainee hold the same pylon for more than one circuit. (See also Technique 1, Section XV, E.)
	21	14	3	9	1	1	3. Have trainee pick out a small rectangular course, and make several patterns around it, using each corner as a pylon. This reduces considerably the time that the wing must be held on the pylon and, in addition, improves the trainee's timing on the "roll in" and on the "roll out."

XVII. NORMAL TURNS

Training problem	A	B	C	D	E	Omit
A. Explanation and demonstration of control movements in turns.	15	29	1	4	0	0
	5	37	2	2	2	1
B. Trainee holds rudder in turns.	3	40	3	3	0	0
	1	38	4	4	1	1
	0	39	1	3	5	1
C. Trainee overcontrols rudder.	11	34	1	1	2	0
	7	12	2	20	6	2

Technique

1. Impress trainee with fact that lift force of the wing causes the plane to turn and that the force which the wing must overcome is centrifugal force.

   Point out that the sharper the turn, the greater the amount of lifting force which must be devoted to overcoming centrifugal force and the lesser amount which remains to support the plane. (Demonstrate by executing 45° banked turns with no back pressure or some turns of short duration with varying degrees of bank.)

   Make clear the effect the ailerons have at various airspeed and at corresponding angles of attack.

   From lesson to lesson elaborate on these facts, for instance discussing the effect that the use of aileron only has on the recovery from turns and the effect of the rudder at all speeds.

2. Exaggerate control movements slightly in first demonstrations, since pressures may be almost imperceptible to trainee in first stages of his training.

1. Demonstrate how feet can be removed from rudder after turn is established, and direct trainee to practice turns using this procedure. (3)

   a. Have trainee follow this procedure, rolling from one bank into another.

   b. Emphasize that during the turn, with the exception of slight opposite aileron, all pressures are released except back pressure.

1. Explain clearly why rudder is used only to counteract aileron drag in turns and demonstrate in air.

2. On tandem planes, put your hands under the trainee's feet on the rudder pedals, telling him not to press hard enough to hurt your hands. This will encourage the trainee to use light pressures and to release them as soon as possible.

Training problem A	B	C	D	E	Omit	Technique
3	24	3	12	5	2	3. While instructor operates the stick, have trainee make turns using very little rudder, and demonstrate that just a little rudder will result in good turns if proper aileron pressures are coordinated with it.
5	22	2	13	6	1	4. Direct the trainee to use only the toes of his feet on the rudders, and check carefully to see that this is done.
1	17	0	13	3	14	5. See technique 3, Section XVII, D.
D. Trainee is weak on rudder.						1. Have trainee make medium turns using rudder alone.
2	24	5	13	3	2	a. Trim plane for straight and level flight. Have trainee remove hands from stick, and make 180° turns, using rudder alone, not exceeding 15° bank, and applying rudder smoothly so that skidding is kept at a minimum. After becoming proficient on 180° turns, direct trainee to make 90° turns.
5	15	10	15	2	2	
7	19	3	12	7	1	2. Have trainee use the rudder alone (instructor operating the stick) and have him practice a rolling S turn up a straight road. Until a trainee relaxes and learns to use his feet, have him speed up the roll until he is finally doing a fairly good coordination exercise by holding straight heading and rolling the airplane left to right. See technique 3, Section II, B.
7	12	1	21	7	1	3. Place your hands on the trainee's feet (in tandem planes) and help him use the rudder while doing coordination exercises. See also technique in Section II, B.
E. Trainee overcontrols aileron.						1. Stop the slipping turn immediately. Have trainee start turn again, applying light rudder and aileron pressure, watching carefully for cues to slipping.
5	24	4	7	8	1	
7	37	0	5	0	0	2. Pick a point off the nose, and bank the plane, recovering to straight and level with just the stick. Point out to the trainee how the nose swings away from the point. Then bank the plane and coordinate stick and rudder in the recovery, pointing out to the trainee how much smoother it is, and how the nose stays on the point.

Training problem	A	B	C	D	E	Quit	Technique
F. Trainee overcontrols generally.	2	46	0	0	0	1	1. Demonstrate that a turn can be made either by sudden and violent application of considerable control pressure or by application of lesser pressures which are held longer.
	12	13	0	18	6	0	2. Have trainee follow through while you do a series of turns using barely perceptible movements of the controls. Then cup your hands around the stick with thumbs and fingers barely touching and have the trainee practice turns without touching your hands.
	9	26	2	9	2	1	3. Tell trainee to exert control pressures as if he had all day to make the turn.
	12	30	1	5	0	1	4. Repeatedly remind the trainee that a turn of 5° is done exactly the same way as a turn of 360°. (See also techniques in Section II, C.)
G. Trainee's coordination as a whole is poor.	11	15	0	9	13	1	1. Have trainee practice at home with a chair and a broom stick, moving feet and stick together to develop his leg-hand coordination.
	14	9	1	16	8	1	2. Put trainee in plane on ground with tail on box in level flight position. (Tie plane down firmly so that the wind won't tip it over or blow it away.) Then have trainee practice coordinated use of controls. (2)
	11	36	0	2	0	0	3. Instruct trainee to be constantly looking for the cues that tell him he is skidding or slipping. Then purposely demonstrate incorrect methods of coordination, directing trainee to tell you what is wrong. (See techniques in Section XVII, H.)
	3	10	4	14	16	2	4. On wheel planes, be certain that trainee is grasping the wheel on one side, rather than directly at the top. This may cause him to drag a wing for a while but that can be cured.
	3	35	1	3	0	7	5. Emphasize work on coordination exercises (3) e.g.,
	11	35	1	1	0	1	a. Alternate climbing and gliding turns holding constant bank and varying banks from shallow to steep and back with emphasis on proper rudder, aileron, and throttle coordination.
	18	28	0	2	0	1	b. Have trainee execute shallow bank, steepen it to a medium bank, increase it further to a steep bank, then decrease bank to a medium, then a shallow bank, and after recovery to

Training problem						Technique
	A	B	C	D	E	Omit	
					straight and level repeat the precedure in the other direction.
	7	38	0	2	0	2	c. Have trainee roll slowly from bank to bank down a road, varying heading 30° each side of the road, and rolling continuously.
H. Trainee fails ro recognize slips and skids.	5	41	0	1	1	1	1. Practice shallow, medium, and steep turns, directing the trainee to apply pressures so that the nose keeps an even speed around the horizon particularly in entry and recovery.
	7	40	2	0	0	0	2. Demonstrate slips and skids in an exaggerated fashion and point out that whenever at the start of a turn the nose of the plane goes in the direction opposite to what you had intended it should, too little rudder or none at all is being used. Whenever the nose swings too sharply in the direction you want it to go, too much rudder, or too little aileron is being used.
	1	46	0	1	0	1	3. Deliberately slip and skid, making turns with ailerons only, and with rudder only, and direct trainee to observe how the nose moves around the horizon. See also technique 1, Section II, F.
	4	16	11	12	3	3	4. Practice turns at low altitude so that the effects of slipping and skidding are more evident. Such errors are most evident in 8's around pylons, in which the pylon will disappear if the nose does not swing around as the bank is increased.
	7	11	8	16	4	3	5. Have trainee follow a winding railroad, insisting that he follow it as accurately as possible, and at just as low an altitude as is safe, considering the surrounding terrain.
I. Trainee fails to maintain altitude in turns.	8	32	4	4	0	1	1. Give intensive ground instruction, explaining with diagrams the forces created in a steep turn, and why the back pressure must be rapidly increased as the turn steepens. Follow the ground instruction with demonstration in the air.
	3	43	0	3	0	0	2. Give the trainee some reference point which should be level with the horizon in a turn, then demonstrate a turn, exaggerating the application and release of back pressure, and showing the trainee the effect on the attitude of the plane.

Training problem	A	B	C	D	E	Omit	Technique
	0	46	0	1	1	1	3. Demonstrate that pressure must be applied as the bank is increased and not after the bank is established or before it is established. Demonstrate as in 2 above. (2)
	1	27	1	9	10	1	4. Emphasize that the nose of the plane will want to drop at about the 90° point in the turn and point out that the trainee should anticipate this and correct for it before the nose actually falls, or the plane slips.
	10	23	3	9	2	2	5. Show trainee the angle the wing tip makes with the ground in a level turn and then practice climbing and diving turns with various degrees of bank, and point out the variations in this angle between wing tip and ground.
	3	38	1	5	0	2	
J. Trainee enters turns nose high and with reduced airspeed.	3	15	2	18	11	0	1. Before entering turns, have trainee check the wing tips with horizon for level flights and the tachometer for cruising rpm.
K. Trainee in side-by-side plane dives in left turns and climbs in right turns.	6	8	1	17	16	1	1. Require trainee to pick a reference point on the center line of the cowl and to keep it the same distance from the horizon during turns in both directions. 2. While in straight and level flight ask trainee where horizon comes in relation to the windshield. Then mark a cross on the inside of the windshield at the proper point. Then direct the trainee to keep this mark on the horizon during both right and left turns.
L. Trainee has difficulty determining various degrees of bank.	0	32	1	11	4	1	1. Demonstrate various degrees of bank and instruct trainee to find some reference point on the plane, e.g., a strut, which is level with or a given distance from the horizon in the various degrees of bank.
M. Trainee banks too steeply in climbing turns.	5	3	0	20	20	1	1. Direct trainee to write "Climbing turns are done with a shallow bank" 100 times.
N. Trainee leans against bank.	6	1	1	26	11	4	1. Have the trainee sit sideways in a rocking chair for a given length of time and have another trainee rock the chair. The trainee sitting in the chair should be instructed to rock with the chair and not against it.

Training problem						Technique
	A	B	C	D	E	Omit	
0. Trainee fails to divide attention between plane and objects outside of plane during turns.	12	21	0	14	2	0	1. For a few periods, instruct trainee to look around at the tail surfaces, both to the left and to the right, during the turn, and to continue to alternate his gaze until he has rolled back into straight and level flight.

XVIII. STEEP TURNS

Training problem	A	B	C	D	E	Omit	Technique
A. Introduction of steep turns.	8	39	0	0	2	0	1. Talk trainee through a graduated series of turns in which the degree of bank is continually steepened. Soon he will be performing 60° banked turns without realizing it, and will not have had the apprehension that frequently accompanies the knowledge that steep turns are to be demonstrated and practiced.
	14	21	4	7	2	1	a. Never mention the words "steep turn." Just direct trainee to let the bank get steeper and insist that he hold nose up, increase throttle, and rolls out at the 360° point.
	7	34	0	6	0	2	2. Before introducing steep turns, have trainee practice coordination exercise involving shallowing and steepening bank, and maintaining constant altitude. (2)
B. Trainee's coordination in steep turns is poor.	12	34	0	2	0	1	1. Instruct trainee to start a steep turn, and then to reverse direction (rolling from one turn into another) every 180 degrees (2)
	2	29	3	12	3	0	2. Have trainee make five to ten 720° turns, each turn somewhat steeper than the previous one. Then instruct him to roll from one 90° turn to another, gradually steepening the bank to help perfect recovery technique.
C. Trainee loses altitude in steep turns.	4	43	0	1	1	0	1. Instruct trainee to decrease bank rather than to hold top rudder.
	7	21	8	11	1	1	2. Have the trainee put the plane in a steep bank, and as the nose travels around the horizon, have him vary the back pressure so that the nose travels above and below the horizon in an "ocean wave" pattern. This exercise increases his "feel" of elevator pressures.
D. Trainee allows bank to shallow in steep turns.	0	23	3	13	8	2	1. Direct trainee to attain desired bank, making sure proper control pressures are used. Then instruct trainee to hold enough back pressure to keep nose level during the turn and not to worry about the other controls.
E. Trainee forgets sequence in series of turns.	4	1	3	21	18	2	1. Tell the trainee to hold up his hand, and then say, "This little finger is for the first 90° turn into the wind, the next finger is for the second 90° turn in the opposite direction, the middle finger is for the 180° turn in the oppo-

Training problem

Technique

site direction, the index finger is for the 180° turn in the other direction, and that damn big thumb is for that 90° turn into the wind which precedes the 360's. -- hereafter count the turns on your fingers."

XIX. SLIPS

Training problem	A	B	C	D	E	Omit
A. Trainee has difficulty maintaining direction during forward slip.	1	47	0	0	1	0
	3	34	2	3	5	2
	2	14	2	10	19	2

Technique

1. Pick object on the ground toward which flight path of plane is to be directed.

2. Explain slips as being primarily an aileron maneuver in which the rudder is used only to control direction over the ground. Aileron is applied first in the direction of the slip, and produces yaw which tends to turn the plane in the opposite direction. After the bank is established, in order to prevent the plane's turning in the direction of the slip, opposite rudder is applied to hold the yaw, or to accentuate it in the amount necessary to keep the track over the ground.

3. Emphasize the necessity of leading aileron both in entering and in recovering from slips. In the recovery the aileron should be returned nearly to neutral before neutralizing the rudder.

XX. LAZY EIGHTS

Training problem	A	B	C	D	E	Omit
A. Trainee does not maintain proper rate of roll in lazy eight.	15	23	2	6	3	0

Technique

1. To aid trainee in getting feel of the proper rate of roll in a lazy eight, direct him to execute a 180° turn in which he takes 90° of turn to roll in, and 90° of turn to roll out. After practicing this maneuver a number of times, tell the trainee merely to add the pull up and dive to the 180° turn and he will have a pretty good start on the lazy eight.

XVI. STALLS

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee is afraid of stalls							1. If the trainee is afraid of stalls it is usually because he fears he will spin out. To counteract this fear, take the plane up to 4000 feet altitude, tell the trainee to watch you, put it in a spin. Providing you know your plane, at two turns let go of the controls and let the plane recover by itself. This should give trainee the confidence he needs in stalls or spins.
	5	23	10	6	3	2	
	6	25	8	7	3	0	2. Do stalls frequently, and let trainee execute maneuver entirely alone, recovering as gently as he wishes. Then instruct him gradually in speeding up the recovery.
	5	20	9	13	1	1	3. Demonstrate and have trainee make a continuous oscillation stall for at least 2000 feet of altitude, explaining how the plane "wants" to recover from stalls of its own accord.
B. Trainee does not have "feel" of stall sensation and cannot detect approach.							1. Do several oscillation stalls, letting the plane go through a number of oscillations, thus giving the trainee additional experience in the sensations accompanying a stall.
	4	33	3	8	1	0	
C. Trainee does not have "feel" of proper control pressures in stall.							1. Do a number of stalls with trainee handling rudder only, the instructor handling the throttle and elevators. This will enable him to devote all his attention to rudder use. Then instruct him to handle throttle and elevator only, concentrating on the elevator pressures just before the break and during the recovery from the maneuver.
	6	13	3	23	4	0	
	9	18	7	12	2	1	2. In explaining necessity for short quick applications of rudder compare its use to that of the steering wheel of a car traveling rapidly down a narrow road, i.e., short quick applications of pressure necessary, and then quick relaxation of pressure.
D. Trainee uses aileron in stall.							1. Have trainee pivot his right forearm on his thigh, so that very little lateral pressure is possible.
	10	12	0	19	5	3	
	3	19	1	13	6	7	2. Have the trainee hold the stick with a "curved arm," i.e., bent at wrist and elbow, rather than pulling straight back on the stick.

Training problem A	B	C	D	E	Omit	Technique
						3. Instruct trainee not to grasp the stick or cup his hand around it. Instead insist that he bend his wrist at right angles to his forearm, with his hand flat, and keep only the flat of the palm of the hand against the stick. (2)
2	13	7	19	4	4	
						4. Have trainee use both hands on stick, keeping it centered, until proper rudder use is learned. (4)
5	11	4	17	8	4	
						5. Tell the trainee to raise his heels off the floor in order to "stay alive" on the rudder and to remind him not to use aileron.
1	7	4	26	7	4	
						6. Have trainee spend one-half hour or so in a plane on the ground and practice coming straight back on the stick while watching the ailerons to see that they don't move. (2) (See also Technique 1, Section XXVI, I.)
7	14	1	20	4	3	
						7. Assign the trainee the single task of keeping the wings level with rudder alone and handle the throttle and elevators yourself. (4)
6	20	1	18	2	2	
						a. Follow procedure indicated above, but continue the stall through several oscillations, bringing the stick farther back on each succeeding stall until a complete stall is reached.
4	24	2	15	1	3	
						b. Follow procedure indicated under 7 above, except that the plane should be taken to 3000 feet and the throttle retarded until plane is just above stalling point. The instructor should hold the plane in a near-stalled position until it "mushes" down to 1500 feet, during which time the trainee should handle the rudder only.
12	13	3	14	2	5	
						8. Emphasize keeping the plane on a constant heading throughout the stall, through use of rudder, rather than instructing the trainee to try to keep the wings level. (3)
12	23	1	7	2	4	
						a. Similar to above, except that until the stall the trainee should be instructed to use coordinated rudder and aileron movements, and using rudder only to maintain heading during dive.
3	9	5	12	17	3	
						b. Have trainee watch relationship between left wing and the ground during maneuver in order
10	13	0	16	7	3	

Training problem						Technique
	A	B	C	D	E	Omit	
							to maintain directional control through use of rudder. If the wing "backs up" in relation to the ground it should be moved ahead by right rudder pressure, and vice versa. (Watching the wing also makes trainee conscious of angle of attack and enables him to check visually on whether aileron is being used.)
E. Trainee tends to make "secondary stall" during stall recovery.	8	17	6	10	4	4	1. Instruct trainee to push the stick forward and immediately to let go of it as if he were hitting a punching bag. After the stick returns to neutral, the trainee should take it again and add only enough back pressure to hold the nose level until the plane picked up speed again. After a little practice the trainee should learn to handle the stick properly without letting go of it.
F. Trainee does not correct for torque in stall recovery.	10	28	2	7	1	1	1. Return plane to level flight, and throttle back. Then apply full throttle as in a stall recovery but use no right rudder, demonstrating how the nose swings to the left.
	6	7	4	24	3	5	2. Have trainee trim plane for level flight, and instruct him to bend his fingers in front of the stick, but not to grasp it. Then instruct him to move his hand forward approximately four inches (as he would the stick in a stall recovery) and immediately afterward to open the throttle completely holding the nose straight with rudder alone.
	5	10	2	21	9	2	3. Instruct trainee to keep his left foot on the floor and off the rudder pedal while making his stall recovery. State that the torque will take the place of his left rudder pedal, and if he uses too much right rudder, he should merely release the pressure and let the torque straighten the plane out.
G. Trainee does not know when to make recovery for various stalls.	8	34	0	5	0	2	1. Explain in detail the similarity and difference between the stall being demonstrated or practiced and the previous stalls in the series. Have the trainee explain each stall separately before he executes it. (2)
	7	24	0	13	1	4	2. Attain slow flight (see Section VIII) and demonstrate and explain how a slight decrease in airspeed, either through retarding the throttle or raising the nose, results in a complete stall. When the trainee recognizes the speed just above stalling, have him do a #1 stall. Then demonstrate #2 and #3 stalls, showing the trainee when the recovery should be made.

Training problem A B C D E Omit	Technique
	Then do a few full stalls, instructing the trainee to call out 1, 2, 3, when he thinks the recovery from each of these respective stalls should be made. Then have him do a few complete stalls, calling out "1," and "2," when recovery from those respective stalls should be made, and then recover from the #3 stall at the proper time. This procedure can be used for both power-off and power-on stalls.
H. Trainee "falls off on wing" in power stalls. 3 34 3 8 0 1	1. This often results from the fact that the climb is assumed too quickly. Slow the speed down somewhat before assuming the climbing angle by pausing for a few moments with the nose just a few degrees above the level flight attitude. Then raising the nose higher at a steady rate will produce the stall just as the maximum angle is reached, at which time the stick should be <u>all the way back</u>.
7 23 2 10 4 3	2. Have trainee stall the plane, first with one wing intentionally low, and then the other. Instruct him to note that if the plane stalls with one wing low, the plane falls off in the other direction. Then continue practice in correction for the low wing.

XXII. SPINS

Training problem	A	B	C	D	E	Omit	Technique
A. Introduction of spins.							1. Before the first demonstration tell the trainee exactly what you are going to do, then demonstrate a spin, talking throughout. Then again explain to trainee how the spin is executed, and have him try it. Following the trainee's first trial, just correct one fault at a time, until he has the idea.
	6	42	0	0	0	1	
							2. Before going up for the first demonstration, explain the maneuver, and go over the explanation again on the way to the practice area and while climbing. Then demonstrate two or three spins, explaining each one as it is executed, and allowing considerable time between each demonstration. Then discuss the execution of spins again on the ground after the flight.
	10	23	5	6	5	0	
							In the next lesson, again explain the maneuver, and then ask the trainee if he wouldn't like to try one.
B. Trainee is afraid of spins.							1. During the first demonstration of the spin try to keep the trainee's mind off the sensation of spinning. Talking to him an a calm natural voice all the way through helps. (See Technique 1, Section XXII, A, above.)
	5	43	0	1	0	0	
							2. Demonstrate a spin when the trainee is not expecting it (but after preparing him by practicing rather violent maneuvers such as stalls and steep turns), thereby relieving much of the apprehension of the first spin demonstration. (6)
	4	13	12	9	10	1	
							a. After a number of stall demonstrations, put the plane into a spin. Tell the trainee that "there is your dreaded spin, and you see you were worked up for nothing."
	3	13	7	17	8	1	
							b. Practice a few stalls, and then go on to steep turns, finishing up by stating: "Now I'll show you what can happen if you use too much rudder in the entry to a steep turn." Do a one-turn spin out of the bottom. Watch the trainee's reactions and let that govern whether further spins should be done.
	6	14	4	10	13	2	
							c. During stall practice, state: "Now notice what happens if just as the plane stalls I shove in hard rudder." Follow with explanation of spin.
	5	20	8	7	8	1	

Training problem	A	B	C	D	E	Omit	Technique
							d. After entering spin in conjunction with stalls (as in c above) tell trainee to press full opposite rudder, the instructor holding the stick in neutral. Explain to the trainee that a spin is first of all a stall and that he pushed opposite rudder and actually recovered from the spin himself. Explain that a spin is not deadly, but a logical maneuver.
	3	24	5	10	5	2	
							e. Let trainee do a complete stall, but direct him to make no attempt to keep the wings level. This will usually result in an approximation to a spin. Then explain that with the use of full rudder in the direction the plane starts to fall off, a complete spin will result.
	6	29	2	7	4	1	
							f. When about to demonstrate spins, don't call them spins. Tell the trainee that you are going to demonstrate a "stalling turn," and after it is over inform him that the maneuver is often called a spin. (See also Technique 1, Section XXI, A.)
	6	15	1	17	8	2	
C. Trainee has difficulty with spin entries.							1. Have trainee close the throttle and bring the plane to what he believes is landing position, checking the ailerons visually to see if they are straight. Then instruct him to keep the nose on the same spot on the horizon with elevator pressure until the stall occurs, then recover.
	5	37	0	6	1	0	
							The next time, direct him to apply full rudder at the time the stall occurs, not before or after, but just as it occurs. (This skid entry into a spin works well in some planes, but not so well in others.)
							2. Explain that in entering a spin, full rudder and stick full back should be used at the time that recovery is started from the normal stall.
	6	28	1	8	2	4	
D. Trainee loses orientation during spins.							1. Instruct the trainee to select a road or section line running crosswind and to note its characteristics, or some prominent landmark on that part of the road on the left hand side of the up-wind direction. Enter the spin up-wind, and direct the trainee to begin his recovery from a spin to the right, the second time he sees the road and prominent landmark come into view (this is the one and three-quarter turn position). The recovery will usually be on a perfect two-turns
	3	36	2	6	2	0	

Training problem A B C D E Omit	Technique
	heading. (This procedure is effective in light planes, and for a spin to the right. On a spin to the left, a landmark should be picked on the right-hand side of the road.)
5 37 2 2 1 2	2. Have the trainee count the turns out loud, by half-turns.
1 18 8 15 4 3	3. Have trainee count half-turns, and apply control pressures on certain counts. (See also technique under Section XXII, E, following.)
E. Trainee exhibits poor rudder action in spin recovery. 7 15 1 9 17 0	1. Instruct trainee to use the rudder as a brake when coming out of spins. Rudder should be applied smoothly and steadily, fairly rapidly if spinning fast, more slowly if spinning slowly, so that full opposite rudder pressure is exerted just as the heading for recovery is reached. Not until this point is reached should back pressure be released.
F. Trainee uses too little forward pressure in spin recoveries. 4 16 3 20 3 3	1. To impress trainee that to stop a spin requires forward pressure, have him power spin the plane, then while holding the stick hard back, apply full opposite rudder. On some clean planes such as a Luscombe, very little happens except that the spin tends to flatten after about 4 or 5 turns. However, a poorly rigged Waco, for instance, will slow down in as little as one-half turn and go the other way.
G. Trainee uses too much forward pressure in spin recoveries. 5 13 7 17 7 0	1. Have trainee hold the stick back with the palm of his hand, not grasping it at all. On recovery he should put his hand forward, allowing the stick to follow, thus making a nice smooth recovery. (See also technique 2, Section XXI,F.)
H. Trainee uses too much throttle in spin recoveries. 4 22 6 9 7 1	1. Demonstrate a few spins and direct trainee to watch the air speed indicator throughout. Call his attention to the fact that when the plane stops spinning, its speed is equal to or greater than the cruising speed, and that it is ready to be pulled up at once, without throttle.
I. Trainee's timing in application of controls during spins is poor. 8 16 2 18 4 1	1. Put the trainee in a plane on the ground, and have him go through the whole spin procedures, explaining to you just what he is doing as he does it when he closes the throttle, eases stick back, when the plane has stalled, when he applies full rudder and holds the stick back. He should "recover" upon direction of instructor.

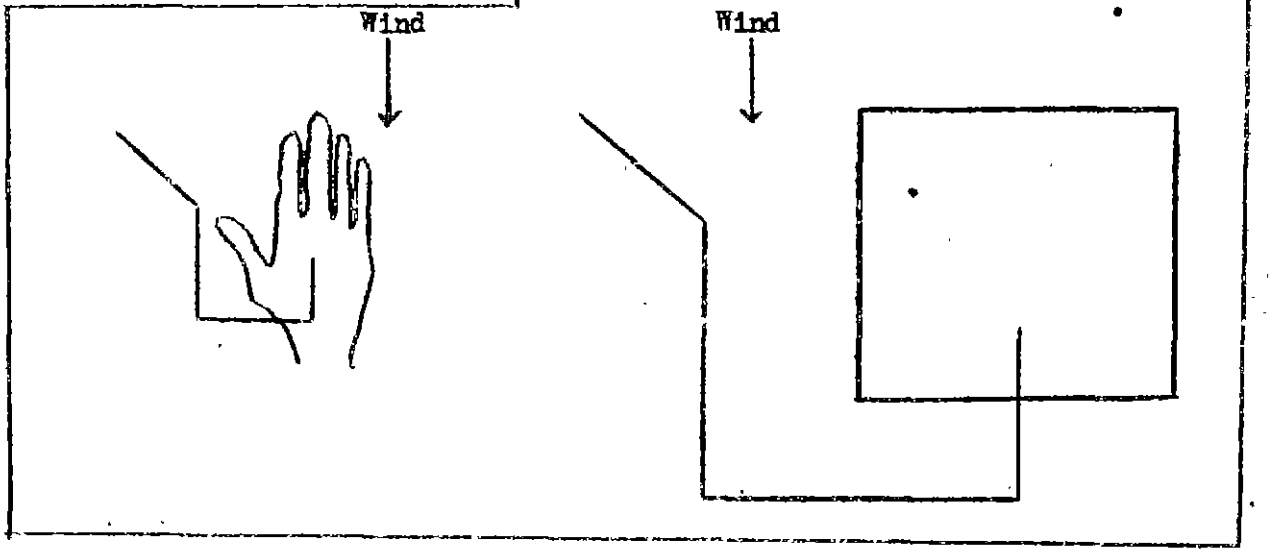
Training problem A	B	C	D	E	Quit	Technique
4	12	4	26	2	1	2. Similar to technique above, except that trainee is directed to count imaginary turns of the spin, applying full opposite rudder at the count of one-and-one-half and moving the stick positively forward at the count of two. This procedure should be demonstrated on the ground by the instructor, and then practiced on the ground by trainee.
2	5	1	30	10	1	3. After each dual period in which spins are practiced, have the trainee write in his own words how a spin is entered and recovered from. Continue this until he is letter perfect.

XXIII GLIDES

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee has difficulty in estimating gliding speed.	2	13	4	9	11	0	1. If trainee watches airspeed too much, leave pitot cover on for a few flights.
	10	15	2	19	1	2	2. Tape up airspeed from 0 to 100 mph (in secondary planes) leaving the rest uncovered for acrobatic use. In lighter planes the airspeed indicator might be taped from zero to 5 mph below cruising.
	8	21	3	16	0	1	3. Never paint out airspeed indicator or remove it completely. Use masking tape which can be removed in situations in which airspeed should be observed (When the airspeed is covered up always give the trainee some points to take the place of the instrument reading.) (2)
	5	14	11	9	9	1	4. Tell the trainee that gliding speed can be estimated by pulling back on the stick rather fast and noting the movements of the plane. If there is a fast reaction to this movement, the gliding speed is too high. If the reactions of the plane are slow, the speed is too slow. Demonstrate at fast and slow speeds, and at the correct speed. After the trainee has noted the plane's reaction at the various speeds, cover up the airspeed and let the trainee judge his gliding speed by feeling the reaction of the plane to the "flipper" controls. (For further techniques in reference to glider, see "Landing Approach," Section XXV.)

XXIV. AIRPORT TRAFFIC PROCEDURES

Training problem							Technique
	A	B	C	D	E	Omit	
A. Trainee fails to observe landing signals.	12	34	1	0	1	1	1. Take an active interest in the landing signals, wind tee, etc. and try to see that trainee does the same. Ask the trainee which way the traffic tee is pointed at a time when he will have difficulty telling you because of distance. Do this, and similar things, in a manner that indicates that you don't know but really think it important that you do.
B. Trainee enters traffic pattern incorrectly.	20	4	4	15	3	3	1. For left hand traffic, place the left hand with thumb extended and palm up, pointed in the direction of the take-off (the wind direction). To enter traffic, follow the extended thumb of the left hand into the traffic pattern around the field. For right hand traffic, use the right hand in the same manner.



XXV. APPROACH TO LANDINGS

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee has difficulty keeping plane straight on landing approach.	4	26	0	17	2	0	1. Give extensive practice in flying straight and level.
B. Trainee has tendency to "stretch" glide.	11	26	1	5	6	0	1. In practicing approaches and landings, refer continually to the throttle as the "glide stretcher."
C. Trainee has difficulty in estimating distance plane will glide.	3	28	3	6	2	1	1. From the time the throttle is closed, ask the trainee frequently if he thinks he will make the field.
	19	29	0	1	0	0	2. Impress on trainee that he should not think of altitude in terms of feet, but in terms of "maneuvering space," considering the velocity and direction of the wind.
	6	41	0	2	0	1	3. During approach, have trainee alternate glance from the path of the plane to the spot he intends to land.
	16	14	6	8	2	3	4. Direct trainee to think of the angle between the line of sight to the landing circle and the ground as the "altitude angle." In a 180° approach, as the plane is traveling downwind, this angle will decrease. As the plane is in the crosswind position the rate of decrease of the "altitude angle" will lessen. Shortly before, or as the plane turns into the final leg of the approach, the rate of change of the "altitude angle" should become zero and the angle should be constant during the final leg. If this angle increases, the plane is overshooting. If it decreases, the plane is undershooting. A constant angle indicates "hitting the spot."
D. Trainee has difficulty in estimating drift.	4	4	3	28	9	1	1. Drive with the trainee in an automobile, and show him how the lines of a road would look if the car were skidding, i.e., how the lines of the road would come through the right side of the windshield if the car were skidding to the right, and vice versa. Then draw long white chalk lines up the instrument panel and over the cowl directly in front of the trainee. This will serve as a guide for him to match up with the ground lines.

Training problem						Technique
A	B	C	D	E	Omit	
11	30	1	7	0	0	2. Teach the trainee to do a bit of thinking about the wind while he is on the ground waiting his turn to fly. Have him estimate the velocity, see whether it is gusty or shifting, etc. (See also Technique 2, Section XIV, C.)

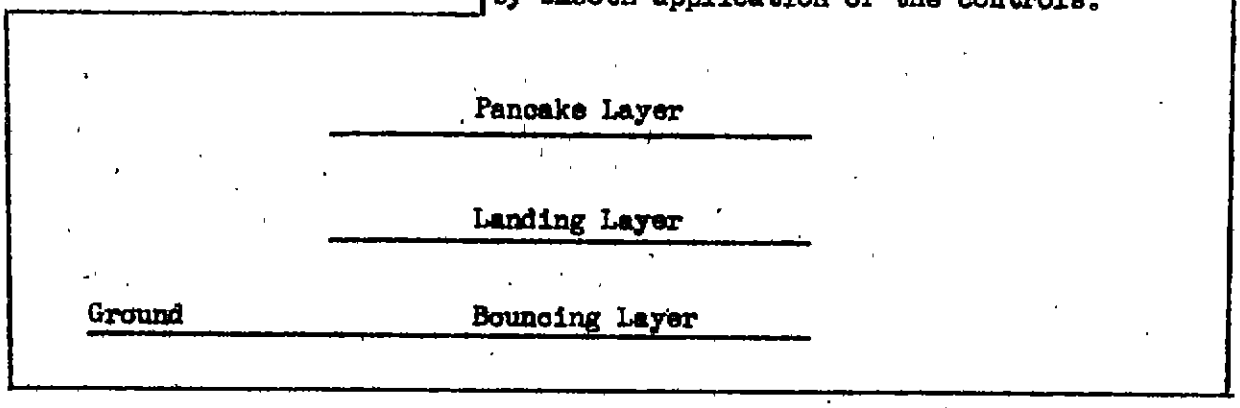
XXVI. LANDINGS

It will be noted that the classification of techniques in this section in terms of the training problems to which they refer, is not as clear-cut as in certain other sections. The various steps in the landing procedure are closely interrelated. Thus, variations of similar techniques will be found classified under different training problems, depending upon the particular aspect of the landing procedure emphasized by the technique.

Training problem						Technique
	A	B	C	D	E	Omit	
A. General procedure in landing instruction.	1	36	1	5	5	1	1. In introducing landings, use the "just another maneuver" angle. If possible, don't stress landings until the last two hours before solo.
	0	28	2	11	6	2	2. Try to make the trainee see how simple it is. Tell him that landing is as easy as 1-2-3. (1) he breaks the glide with a small amount of back pressure, (2) pauses a few seconds, (3) watches the ground anywhere from 20 to 50 feet in front of the plane, then pulls the stick back as fast as possible without the plane buoying up away from the ground. In case the plane does buoy up, stop the back pressure, then as the plane starts to settle, get the stick all the way back.
	9	34	0	3	1	2	3. Break landings down into three simple parts and explain:
	10	36	0	1	0	2	a. "The approach" -- which consists of nothing more than a normal glide and a couple of gliding turns.
	8	29	3	3	4	2	b. "The actual landing" -- nothing but a complete stall starting at about eight feet above the ground -- you sure can't get hurt when you're that close to the ground.
	7	31	2	4	1	4	c. "Keeping the plane straight after the landing" -- nothing but fast taxiing which you seem to want to do all the time anyway.
	4	31	2	2	2	8	4. Break the landing down into three parts:
	5	32	2	7	0	3	a. First, while flying at a safe altitude have the trainee find the normal gliding angle of the plane, and assume that the ground is ten or twelve feet under him.
	6	29	2	8	0	4	b. Have him level off from his glide with the nose of the plane just above the horizon.

Training problem						Technique
A	B	C	D	E	Omit	
7	26	3	7	1	5	c. Then as the plane loses speed, have him get the nose up in the three-point position and hold it there until the stall occurs.
9	9	2	23	4	1	5. Compare landing a plane to bringing a car in to a curb and parking. As a driver comes up to where he wants to park, he heads toward the curb. As he nears the curb he starts to level out parallel to the curb or to decrease his "rate of approach" to the curb. As he approaches the curb he slows down both his speed and his rate of approach until finally he is parallel to the curb and stopped. As a trainee comes down to land, he drops at 300 feet per minute, then 200, then 75, then 25, then 5, until he is parallel to the ground and slowing up. Then the object is to hold the plane slightly off the ground and lose airspeed by applying back pressure to the stick.
15	8	6	18	0	1	6. Tell the trainee you are going to take up the maneuver "skimming the runway." Instruct him that you will go out farther on the approach and come in under part throttle. State that you will handle the throttle and that he will handle the other controls. Direct him to fly at a constant altitude of 5 feet above the runway, and caution him <u>not to let the wheels touch</u>. After skimming the runway a number of times until the trainee is proficient, on the next trial slowly inch the throttle back, at the same time directing the trainee to "hold her off, don't let the wheels touch." The trainee will gradually pull the stick back, and by the time it is all the way back, the throttle should have been closed and the plane will settle in on three points. Then point out that the secret of good landings has been demonstrated -- hold the plane off as long as possible and when it is ready it will land. Then proceed with the usual landing instruction, repeating this skim the runway procedure when necessary. (The contributing instructor points out that this technique gives the trainee prolonged practice in leveling off, whereas in ordinary land-

Training problem						Technique
A	B	C	D	E	Omit	
						ings, this part of the maneuver is over in a few seconds. He stated that he first used this technique only on trainees who were having difficulty, but now uses the method to introduce landing to all trainees.) (See also Technique 3, Section XXVI, C.)
9	11	4	19	3	2	a. Follow the skim the runway procedure, making actual landing every third time. On trials when no landing is made, fly at various speeds.
3	5	1	17	20	2	7. Give wheel landings before full stall landings. If one tries to teach full stall landings and keeps harping on the getting the stick back the trainee will concentrate on it so heavily that he will stall too high off the ground.
3	18	12	12	2	1	8. During dual practice, have trainee make tail low landings. This will lead to better three-point solo landing.
B. Trainee has difficulty determining height above ground at which to level off.						1. Draw a diagram as indicated. Suggest to the trainee that landing is merely a matter of coming down and beginning the leveling off in time so that the wheels of the plane are in the landing layer, and then holding the plane in this layer. If the level off is too late, the plane will pass through the landing layer and into the bouncing layer. If the level off is too early, the plane will pancake. Once the plane is placed in the landing layer it should be held there by smooth application of the controls.
15	14	3	13	3	0	



Training problem A	B	C	D	E	Omit	Technique
9	26	1	10	2	1	2. Fly plane at height above the ground at which the plane should be leveled off, directing the trainee to note the perspective of the runway and field. After the demonstration, have the trainee repeat this maneuver a number of times. (See also Technique 3, Section XXVI, C, and Technique 5, Section XXVI, A.)
12	21	4	9	2	1	a. Have the trainee vary his height from just above the runway to 6 or 8 feet, noting the appearance of the field and runway at the various heights.
5	8	11	20	4	1	3. Fly across the field at low altitude, but at various heights, instructing the trainee to call out the different altitudes in terms of intervals of 5 feet as the height above the runway changes.
C. Trainee fails to recognize landing stall.						
4	43	0	0	1	1	1. First review stalls at a safe altitude and then have the trainee "land" in the air a number of times. Then take him back to the field for further landing practice. (3)
13	32	2	1	0	1	2. Spend a short period of time on stalls and approach to stalls in each lesson after the fourth hour. Spend at least 10 minutes flying at slow speed at a safe altitude during every lesson after landing instruction has started. If given confidence in their ability to recognize the approach to a stall, trainees' landings will improve faster.
8	29	4	7	0	1	a. Teach the trainee the feel of elevator pressure in stalls and get him to realize that the slower the plane flies, the farther back the stick must come in order to maintain the same amount of elevator pressure. Finally, in a full stall landing, the stick is all the way back. Thus, the point at which the glide should be broken can be determined to some extent by feel.
8	17	4	14	5	1	3. Demonstrate the procedure of flying the length of the runway at extremely low altitude. (See Technique 2, Section XXVI, B.) After the trainee becomes proficient in this procedure, tell him that you will handle the throttle. Then on subsequent trials, vary the power setting, directing the trainee to maintain a constant height above the runway by appropriate use of back pressure. (See also Technique 5, Section XXVI, A.)

Training problem						Technique
	A	B	C	D	E	Omit	
	6	18	6	16	2	1	4. Stress the fact that the trainee's sensations from the point of breaking the glide will be one of straight and level flight followed shortly by one of vertical descent. This vertical descent he should control by back pressure on the wheel or stick.
	9	34	1	2	1	2	5. Give practice in slow flight at high altitude. (See Section XIII.)
D. Trainee "mushes" in or dives plane into ground due to incorrect gliding speed.	2	8	12	20	5	2	1. If trainee has tendency to dive into ground have him break his glide when he is about 500 feet from the end of the runway -- even though it will result in his overshooting. Finally the trainee will begin to see the effect of his breaking the glide before diving into the ground.
	1	34	4	7	3	0	2. On the final approach, when sure of the field, be certain not to be above a normal gliding speed. When around 50-70 feet, have the trainee start breaking the glide very slowly and when the plane gets down close to the ground it will set on in without undue floating. (The height at which to break the glide varies with the type and weight of the plane.)
	2	22	4	11	9	1	3. In beginning instruction, it is best to glide in a little fast, and have a little extra float, rather than to use the mush in, or drop in type of landing. Later on a landing with less float can be taught.
E. Trainee has difficulty in applying back pressure properly.	3	41	0	3	2	0	1. Show the trainee a normal glide, a slow leveling-off process which starts at about 15 feet above the ground and finally levels off at about two feet. Then instruct him to let the plane settle a little closer and then hold it off the ground by applying back pressure on the stick, increasing the back pressure so that as the plane settles to the ground the stick is all the way back.
	2	30	6	7	2	2	2. Remind trainee to observe the position of the nose when the plane is sitting on the ground, then during the approach, tell the trainee to put the plane in that position after leveling off, and to hold it there until contacting the ground, and then not to release any back pressure until it stops rolling. (2)
	4	27	6	7	3	2	3. Tell the trainee to come back with the stick as quickly as possible after leveling off without causing the plane to get farther from the ground.

	Training problem					
	A	B	C	D	E	Omit
4.	5	32	2	5	0	4
a.	2	38	3	4	1	1
b.	2	9	11	19	5	3
c.	3	12	4	25	4	1
d.	2	7	5	19	15	1
5.	8	21	3	10	4	3
F.	Trainee does not know where to look while landing.					
1.	0	27	1	9	12	3
2	1	32	2	7	5	2
3.	8	27	4	9	0	1
4.	13	19	1	4	1	3

Technique

4. Instruct the trainee merely to try only to keep the plane flying, or in the air, just above the ground as long as possible. (3)

   a. Just tell the trainee to get the plane 2 or 3 feet above the ground and to try to keep it from landing.

   b. Bring the plane in fast and have the trainee hold it about 2 feet above the runway as long as possible.

   c. Tell the trainee that his landings have been fair, although not good, but that further practice will iron things out. Then state that one further maneuver is to be taken up, namely, "power-off landing prevention." Then proceed as indicated above.

   d. Avoid reference to the position of the nose, tail, or stick.

5. Stress that after leveling off, once the stick starts its backward travel, it never again, under ordinary circumstances, moves ahead. If the vertical descent stops, the backward movement of the stick or wheel stops until vertical descent is resumed.

F. 1. Require the trainee to break his glide at from 10 to 15 feet and to look well ahead at some object on the runway or near it.

   2 Have trainee shift his gaze so that he can see the ground about 50-75 feet ahead of the plane.

   3. On one or two demonstration landings, tell the trainee exactly where you are looking, e.g., just this side of that taxiing airplane, at the bare spot on the runway, etc.

   4. Have trainee look at ground directly below the plane while taxiing. Point out that the ground is blurred because he is looking too close to the plane. Then tell the trainee to look at some object quite a distance ahead and at the angle he should look when making his approach. Point out that by looking too far ahead he has no perception of height. Then tell him that when he is coming in on landings, the correct distance to look ahead of the plane can be

Training problem						Technique
A	B	C	D	E	Omit	
						determined as follows: Look far ahead of the plane, and then bring your gaze closer to the plane until the ground begins to look blurred. Then shift the gaze back a few feet from this point until the ground no longer is blurred.
1	18	7	14	8	1	5. Have trainee look out on both sides in his glide, and just before he lands instruct him to look about 20 feet ahead on the left side of the plane.
4	8	5	21	10	1	6. Put a mark on some object on the ground. Taxi the plane about 20 feet from this spot and in a position so that the spot is visible to the trainee but so that he is unable to see it over the nose of the plane. Tell him that this is the distance ahead, and the direction he should look when landing.
4	3	8	25	8	1	
G. Trainee continually looks over nose of plane during landing, instead of out to one side.						1. Hold a piece of cardboard over the center portion of the windshield to force trainee to look out to one side of plane.
3	8	7	22	8	1	2. Use arms and hands to cut off forward vision and force trainee to look out left side of plane to complete landings.
H. Methods of determining if trainee is looking at right place during landing.						1. The only way to be sure that the trainee is looking where he should is to <u>watch his eyes in the mirror</u>.
1	25	1	10	12	0	
2	34	2	4	6	1	2. If trainee consistently lands too high he is probably looking too close to the airplane. If he comes in too low he is probably looking too far away.
5	21	2	9	8	4	3. If the trainee flies into the ground, he is probably looking too close to the plane. (The contributing instructor states that he has found this to be true, the apparent logic behind the statement in CAB 23, page 170, notwithstanding.)
I. Trainee continually lands with one wing low.						1. During landing practice, while taxiing back for each new take-off, instruct trainee to practice drawing the stick straight back (as for a landing). This aids him in getting the stick all the way back without use of ailerons, at the same time he is giving his attention to several other jobs. (See also technique 6, Section XXI, D.)
4	28	3	11	2	1	

Training problem						Technique
	A	B	C	D	E	Omit	
							2. Explain to trainee that as the stalled condition is approached the aileron controls become sluggish but that aileron control does exist throughout the landing procedure. But emphasize that if he keeps the wings level until the plane reaches the stalled condition he is just a few inches off the runway, and he need not worry about whether or not he should or should not use aileron during the landing stall.
	2	30	0	12	4	1	
J. Trainee forgets or is too busy to adjust stabilizer (in heavy planes).	6	41	0	1	1	0	1. When the trainee enters his approach glide, instruct him to bring the nose to the normal glide position by adjusting the stabilizer. Thus the trainee does not have to check on the stabilizer position indicator, but can adjust the stabilizer by feel.
K. Trainee's recoveries from bad landings are poor.	5	33	3	3	2	3	1. Trainees may not know the cause of a bad landing, and thus be unable to use proper correction in recovery. The effectiveness of the following mechanical numbering of bad landings in teaching recoveries depends on the integration of the procedure with the actual flight instruction. The listing of bad landings and corrections for them is as follows:

Glides

#1. Slow glide -- mushing feeling -- results in pancake landing #2. Correction -- get nose down.

#2. Fast glide -- plane climbs when proper back pressure is applied. Correction -- return to normal glide.

Landings

#1. Wheel landings -- caused by too fast glide or not breaking glide. Correction -- fly around again (at least in pre-solo).

#2. Pancake landing -- caused by too slow glide, or breaking glide too high -- fly around again before wheels touch, or even if they do touch (at least in pre-solo).

#3. Tail low bounce landing -- caused by fact that plane is not completely stalled and stick not full back, although glide is broken.

Training problem						Technique
	A	B	C	D	E	Omit	
							Correction -- do nothing -- leave stick where it is. When plane is at top of bounce ease stick full back. If stick is snapped back as soon as the wheels touch, the correction should be the same as #1 -- go around.
							Insist during dual practice that trainee analyze his bad landings by stating what number test describes it.
L. Instruction in use of bad landing recovery in elementary training.	10	37	0	0	1	1	1. Trainees who are mainly fearful of landings should be given a great deal of time on recoveries until they can competently and confidently recover from any type of bad landing. Instructors should realize that more praise is due the man who makes poor landings with excellent recoveries, than the one who just naturally "greases them on" from the start.
	5	37	0	5	1	1	2. Be sure trainee understands the fundamentals involved and can successfully recover from his bad landings. Then teach him to "go around" the field on his first few bad ones after solo.
	10	21	7	8	1	2	3. Do not stress use of throttle in landing recovery too much. This is necessary for trainee to know, but if too much emphasis is placed on it, elementary trainees may use it in very bad positions, resulting in nose-overs, fast ground loops, and stalls close to the ground by pulling stick back and pushing throttle forward.
M. Trainee has difficulty keeping plane straight during landing run.	11	33	1	4	0	0	1. Instruct the trainee to change his focus to a greater distance ahead of the plane after contact with the ground has been made in order to keep the plane straight.
	6	13	17	8	3	2	2. Have trainee deliberately weave the plane slightly on the runway after landing. This will improve his "feel" of the proper rudder pressures, and enable him to loosen up and find that he can control the plane and keep it on the runway. (See also technique 5, Section XIII, C.)
	3	14	10	8	11	3	3. In correcting for ground looping, instruct the trainee to give rapid application of forward stick and throttle together with opposite rudder. Emphasize that use of aileron can be dangerous.

Training problem A B C D E Omit		Technique
5 2 12 12 14 4	4.	In correcting for ground looping tendency don't use opposite rudder to pull low wing up. Just "dump" the stick forward momentarily, using brisk, positive pressure.
4 2 7 24 11 1	5.	Prior to solo give trainees several ten-minute periods in grounded planes, in which they are instructed to repeatedly rap the stick and throttle straight ahead together, imagining that one wing is actually low.
N. Trainee cannot analyze his errors. 19 20 2 8 0 0	1.	Have trainee "talk himself in," describing the procedure he is following. This not only frequently informs him, as well as the instructor, as to where he is making his errors, but also serves to reduce tenseness on landing. (See techniques 2a and 2b, Section I, C.)
O. Trainee is slow to react, or "freezes" to the controls during landings. 1 3 9 14 18 4	1.	On the approach to the landing, suddenly pull the stick forward, or pull it back, trying to get the trainee to respond by resisting your pressures. If no response is forthcoming, tell him to "fight" with you on the controls. If the trainee is coming in for a good landing by accident, push the stick forward and make the plane bounce, or pull it back asking for power until the trainee gets the idea of making corrections rapidly.
P. Trainee needs more landing practice. 6 6 12 20 5 0	1.	Take trainee to a long field, on a calm day, where it is possible to make landings crosswind. Have trainee take off from one end, and when about half way down the field cut the throttle and instruct trainee to land. Then turn around, take off, and make landing at other end of the field. In addition to increasing the number of landings made, this technique gives valuable practice in executing landings with crosswind from both sides.
4 1 6 25 12 1	2.	Put trainee in chocked plane. Hold the tail up in the normal glide position and instruct trainee to simulate leveling off and landing. As he makes proper control movements, lower tail to simulate leveling off and landing.

XXVII. FORCED LANDINGS

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee misses field on forced landings.							1. Point out that the main difference between forced landings and normal landings is the fact that the trainee is away from the home field and familiar landmarks by which he has unconsciously been judging his altitude and the distance the plane will glide. For the first few forced landings cut the throttle at a point 90 or 180 degrees from a good field, and stress constant gliding speed and other methods used in making accuracy landings at the home airport.
	3	42	0	2	1	1	
	5	41	0	3	0	0	2. Give additional practice in accuracy landings at home airport, stressing the use of 90 or 180 degree approach, variations in the base leg, etc. as if the accuracy landing on the home port actually were a forced landing.
	2	20	4	7	0	15	3. See techniques under Section XVIII, Approach to Landing.
B. Trainee doesn't know when to select cross-wind field.							1. Trainee may pass up good crosswind field in favor of poor field into the wind. Draw table, and have trainee copy and memorize it.
	4	17	9	12	5	2	

(For Light Planes)

Wind velocity	Landing direction
0 - 5 mph	Straight ahead to 90° to wind.
5 - 10 mph	Straight ahead to 45° to wind.
10 - 20 mph	Straight ahead, or slight variation.

Altitude	Amount of Maneuvering Possible
0' - 200'	Land straight ahead.
200' - 300'	Straight ahead to 45° turn.
300' - 400'	Straight ahead to 90° turn.
400' - 700'	180° type approach possible.

It should be emphasized that this does not indicate a hard and fast rule, but merely gives the trainee a general idea of what he can expect to do.

C. Trainee blows up on forced landings.							1. Make a game of forced landings by betting trainee a coke on whether or not he will hit the field. (See Technique 4, Section VI, A.)
	3	20	6	17	2	1	

Training problem					
A	B	C	D	E	Omit
4	9	11	16	9	0

Technique

2. Tell the trainee that for a while you are going to play a game. During every period, each of you can give the other two forced landings. If the trainee catches the instructor (trainee cuts throttle and instructor fails to make satisfactory field), the instructor pays two cokes. If instructor catches trainee, trainee pays one coke. (See Technique 4, Section VI, A.)

XXVIII. NIGHT LANDINGS

Training problem	A	B	C	D	E	Omit
A. Trainee has difficulty executing night landings.	2	25	7	6	4	5

Technique

1. The attitude of the nose in night landings is the secret to making good consistent landings. The nose should be kept just slightly above a level flight attitude throughout the whole descent, using the throttle to control the rate of descent to suit the situation. The trainee should look as far ahead as possible, and if there are runway lights, the up-wind lights should be watched at all times after the final approach is started, the throttle being used to make the lights come up slowsly.

XXIX. CROSSWIND LANDINGS

Training problem	A	B	C	D	E	Omit	Technique
A. Trainee is afraid to get his wing down in crosswind landings.	9	18	11	8	2	1	1. Tell trainee to "land on your left (or right) wheel."
	9	30	5	4	1	0	2. Tell trainee to forget about lowering wing, etc., and the talk he has probably heard about cross controlling, etc. Tell him that the wind is trying to push him away from where he wants to go, and that his job is just to keep the plane going straight in the direction he wants it to go.
B. Trainee has difficulty stalling plane for crosswind landing.	14	21	2	8	3	1	1. Have trainee practice landing stalls at high altitude, using crosswind correction.
	18	23	3	5	0	0	2. Mixed in with regular stall practice. Have trainee practice stalling the airplane, at high altitude, in different degrees of slips, requiring him to maintain a constant heading throughout.

XXX. COORDINATION EXERCISES

In previous sections, instructional techniques involving coordination exercises have been presented when they applied to specific instructional problems included in those sections. In this section are presented instructional techniques involving coordination exercises which are more general in nature.

Training problem						Technique
	A	B	C	D	E	Omit	
1.	7	41	0	0	0	1	Give trainee a number of coordination exercises to practice on to break the monotony, but see that at least one coordination exercise is given during each training period. The trainee cannot get too much practice on such maneuvers.
2.	15	30	0	4	0	0	Give climbing and gliding coordination exercises in preference to coordination exercises in level flight -- they more readily develop "feel" of the plane.
3.	4	37	1	4	1	2	Give instruction in rolling from bank to bank, maintaining a constant direction.
a.	4	28	5	8	3	1	Pick out a point in the distance. Instruct the trainee to roll the plane over to one side and as the plane rolls to release rudder pressure. On the recovery from the bank apply rudder and aileron pressure at the same time, and when the plane reaches level flight position and just before it rolls over to the other side instruct the trainee to release rudder pressure. Emphasize that when the plane is level and starts into the other roll, rudder must be released slowly.
b.	8	27	4	7	2	1	First pick a point off the nose, and bank the plane, recovering to straight and level with just the stick. Point out to the trainee how the nose swings away from the point. Then bank the plane and coordinate stick and rudder in the recovery, pointing out how much smoother it is and how the nose stays on the point. After doing this a couple of times, instruct the trainee to bank the plane with stick and rudder, but to recover with stick only. Then have him recover with stick and rudder holding the point. Then put the plane in a few banks, and direct the trainee to recover with stick and rudder, before the plane begins to turn. When he can do this fairly well, tell him, instead of stop-

Training problem						Technique
A	B	C	D	E	Omit	
						ping the recovery at the straight and level position, to carry it over to a bank on the other side, and then to recover while holding the point off the nose. Trainees find this step-by-step method rather simple, and learn to roll from bank to bank smoothly while holding direction in a very short time.
						c. Demonstrate to trainee the relationship between this maneuver and a turn. Have the trainee roll left, right, left, right, and then when the plane is at the bottom of the roll, with the wing fully depressed, ask him to take his hands and feet off both the rudder and ailerons. The plane will then turn, demonstrating effectively to the trainee the relationship between coordination exercises and turns.
7	25	2	14	0	1	

XXXI. INSTRUMENT FLIGHT

Training problem						Technique
	A	B	C	D	E	Omit	
A. Trainee becomes tense or afraid when under hood.	7	36	1	2	0	3	1. Demonstrate how stable the plane is in various attitudes. For instance place the plane in a steep turn and after taking your hands and feet off the controls, permitting the plane to remain in this turn, explain to the trainee that he can accomplish the same thing while he is under the hood if he is thoroughly relaxed. Then, while demonstrating these "confidence maneuvers" with the trainee not under the hood, have him watch the turn and bank indicator and other instruments. Permit him to make a series of turns and other maneuvers enabling him to become familiar with the plane and to watch the relation of the instruments to the position of the plane. (The contributing instructor had used a Fairchild 24W or a Stinson SR6 or SR9 for instrument work.)
B. Trainee overcontrols in instrument flight.	2	42	0	1	1	3	1. Demonstrate the use of the controls with reference to their effect on the instruments, individually, before the hood is placed over the trainee. For instance, take the airspeed indicator, and show the trainee that just a slight correction is all that is necessary to make the instrument behave -- when the needle hesitates the nose of the plane is on the horizon and the hesitation point is when the trainee should act with equal but opposite reaction. The trainee should control the other instruments in the same manner, without jerky corrections. (2)
C. Trainee forgets what he is told to do while under the hood.	1	26	4	12	2	4	1. Give trainee a whole sequence of maneuvers at once, starting with the simple ones and advancing to the more difficult ones. For instance, start with a stall, followed by a 270° turn to the left. After 90° of this turn, start a let-down to 500 feet below the previous altitude, etc.
D. Trainee has difficulty with beam-bracketing.	12	20	3	7	2	5	1. Explain the procedure as if the plane were a blind man, i.e., as if the sense of sound were his hand, and the beam on-course signal were a wall. Have the trainee actually close his eyes and walk along beside a wall touching it with the finger-tips of one hand. That represents following the "twilight zone." If he does not stay parallel to the wall he will run into it (the solid on-course signal) or away from it

Training problem A B C D E Omit	Technique
	(stronger off-course signal). If he loses contact with the wall (gets too far into the off-course signal) he has no way of knowing exactly where he is or how far away from the wall (beam). In either case he must correct his heading until he finds a course that will parallel the wall. And the quicker he is to make the necessary correction, the smaller it will have to be.
E. Trainee has difficulty coordinating controls in plane after completing Link instrument training. 7 2 2 7 1 8	1. During first instrument lessons in a plane, have trainee roll the ball to its extreme positions on either side of the center, while holding the needle in the center position. Also, have him practice putting the needle over to its stops, right and left, while holding the ball in the center. This exercise seems to get across the idea that the controls work the same "on instruments" as they do when flying contact.