A COURSE IN TRAINING METHODS FOR PILOT INSTRUCTORS

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A report on the construction and administration of a course in training methods prepared for the War Training Service, C.A.A., by the National Research Council Committee on Selection and Training of Aircraft Pilots under a special grant from the Civil Aeronautics Administration.

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Executive Subcommittee

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NATIONAL RESEARCH COUNCIL

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Division of Anthropology and Psychology

Committee on Selection and Training of Aircraft Pilots

September 9, 1943

Dr. Dean R. Brimhall
Director of Research
Civil Aeronautics Administration
Washington, D.C.

Dear Dr. Brimhall:

The attached report, entitled A Course in Training Methods for Pilot Instructors, 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 devoted to a description of a course developed by the Committee on Selection and Training of Aircraft Pilots at the request of the War Training Service, Civil Aeronautics Administration and administered to Methods Instructors at an Institute conducted at the University of Minnesota in April, 1943. In this course were embodied the results of research in the field of pilot training conducted under the auspices of the Committee, in cooperation with the Division of Research, Civil Aeronautics Administration. It is hoped that the report will serve to focus attention upon the basic importance of sound training methods and contribute towards the more effective use of psychological principles and results of psychological research in civilian and military pilot training programs.

Very truly yours,

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

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CONTENTS

	Page
I. Organization of the course in Training Methods for Pilot Instructors	vii
II. Administration of an Institute for Methods Instructors	xv
III. Unit Lesson Plans of the course in Training Methods for Pilot Instructors	xix
Outline of topics in Training Methods Unit	xxi
Introduction -- Unit Lesson Plan I	1
Directed Learning -- Unit Lesson Plan II	8
How Trainees Learn -- Unit Lesson Plan III	14
Adapting Training to Individual Trainees -- Unit Lesson Plan IV	25
Keeping the Trainee Interested -- Unit Lesson Plan V	33
Keeping the Trainee Fit -- Unit Lesson Plan VI	44
Steps in Teaching a Trainee to Fly -- Unit Lesson Plan VII	62
Finding out how the Trainee is Progressing -- Unit Lesson Plan VIII	78
Checking Flight Instructor Practices -- Unit Lesson Plan IX	98
Summary of the Course -- Unit Lesson Plan X	102
Appendix A: Bibliography and Sources of Reference Materials in the Instructor's Manual	109
Appendix B: Bibliography and Sources of Materials in the Instructor's Kit and of Other Materials Called for in the Course	115
Appendix C: Representative Samples of Materials in the Instructor's Manual	119
Introductory Remarks	121
25 Opinions on Flight Instruction	129
Transcript of Record 1, Selection A: Poor Instruction	131
Transcript of Record 2, Selection A: Ground Instruction	133

CONTENTS (Continued)

Page

Analysis of Eye Fixations and Patterns of Eye Movement in Landing a Piper Cub J-3 Airplane (abstract) 134

Procedures for the Card-Sorting Experiment 135

Transcript of Record 3, Selection A: Teaching too Much too fast 137

Transcript of Record 2, Selection B: Example of Poor Motivational Technique 139

Transcript of Record 3, Selection B: Bad Instruction on 180° Approaches 141

Transcript of Record 4: Excerpt from good Air Instruction 143

Transcripts of Records 5 and 6: Section of good Ground Instruction 145

Transcript of Record 7: Excerpt of Post-Flight Ground Instruction 149

Flight Instruction Plan and Trainee Evaluation . . . 151

Sample Page for the Instructor's Personal Logbook . 163

Photograph of the Flight Recorder and a Sample Record 165

Description of Motion Photograph of Good and Bad Performance on Selected Maneuvers from a Flight Test, Reel 2 171

Self-Audit for Flight Instructors 173

Photograph of C.A.A.-N.R.C. Piper Cub Instrument Panel 177

A COURSE IN TRAINING METHODS FOR PILOT INSTRUCTORS

I. ORGANIZATION OF THE COURSE IN TRAINING METHODS FOR PILOT INSTRUCTORS[1]

Early practices in pilot training. The Wright brothers taught themselves to fly.[2] So did many other pioneers in aviation. They resorted to self-instruction for two very good reasons: 1, there were no flight instructors; 2, the frail underpowered craft of the early days of aviation could not carry both student and instructor.

It was quickly recognized that self-instruction in flying represented a hazardous type of self-education. With the development of two-place planes, steps were taken to provide flight training. Airplane manufacturers established flight schools for the instruction of potential purchasers of aircraft, in much the same way as the automobile industry, in its early days, provided instruction to those who bought its product. To these were added training centers conducted by flight operators who foresaw the possibilities of the new industry.

In general, flight instruction was largely unregulated, and the quality of instruction varied tremendously, ranging from that given in "Approved Schools" which met certain minimum requirements, established by the Bureau of Air Commerce of the Department of Commerce, to random and illicit training given by unlicensed instructors in unlicensed planes. Most training operations involved merely a licensed pilot instructor who owned two or three planes and hired one or two licensed instructors (often on a part-time basis) to assist in instruction and to carry passengers on trial or sight-seeing flights. There was little in the way of formal requirements with respect to the number of hours to be spent in flight instruction; the maneuvers to be learned; the sequence of maneuvers to be used in training; and the standards of proficiency to be achieved.

With the initiation of the Civilian Pilot Training Program (now War Training Service) in 1939, a major contribution to flight instruction was made through the elaboration and standardization of the requirements for various types of licenses and of instructional content to be used in training pilots for each type of license. This was accomplished, in large part, through the detailed specification of the hours to be spent in each stage of flight training, the maneuvers to be practiced, and the sequence of maneuvers; through the description of how each maneuver was to be performed; and through the formulation of standards of proficiency to be attained during stated intervals of instruction combined with procedures for assessing such proficiency. To these have recently

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[1] Prepared by Morris S. Viteles, University of Pennsylvania, Chairman, Committee on Selection and Training of Aircraft Pilots.

[2] The first three paragraphs of this report are adapted from a paper by E. L. Kelly, Evaluation of present flight training methods. (Unpublished chapter of proposed text in Aviation Psychology.)

been added improved materials for instruction in the form of Patter[3] for instructors and Fundamentals of Basic Flight Maneuvers[4] for use by students. The original forms of both these aids were prepared by E. L. Kelly, through the National Research Council Committee on Selection and Training of Aircraft Pilots; on the basis of an experimental analysis of actual flight instruction with the aid of air-to-ground recording.[5]

Skill in flying vs. skill in teaching others to fly. While such important changes were made, the actual administration of flight instruction nevertheless remained, for the most part, in the hands of persons with interest and experience in flying but little or no experience with methods of training.[5a] In spite of the major contribution of the Civil Aeronautics Administration and allied groups in the direction of standardizing and improving course content, there persisted the point of view that any pilot supplied with the program and materials of instruction could teach others to fly. In other words, there remained the belief -- to be found also in other industries, and even to some extent in higher institutions of learning -- that teaching others is a matter of a "sixth" sense; an "intuitive faculty" which defies explanation; a "hunch," appearing spontaneously in the teaching situation, that tells what is the right thing to do at the right time in training others.

Inauguration of the War Training Service course in training methods. Recently, however, there has developed a growing recognition by the War Training Service (and also by the armed services) of the basic fact that a man may be able to fly well, and still be unqualified to teach others how to fly -- that efforts must be made to develop teaching skill as a necessary accompaniment to skill in flying among those who are given responsibility for training flying personnel.

In the War Training Service program the recognition of this fact has resulted in the introduction of a 30-hour course in the Theory and Techniques of Flight Instruction as a basic unit in the Controlled Secondary Instructor Course, administered by the War Training Service at seven training centers throughout the country. This 30-hour course is a part of the 102-hour ground course for instructor trainees, and is supplemented by provisions for supervised practice teaching and "applicatory exercises" in an 18-hour ground course in flight instruction given by the Flight Contractor.

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[3] Patter for elementary flight maneuvers. Civil Aeronautics Bulletin No. 31, February 1943. Washington, D. C.: The United States Government Printing Office, 1943. (Adapted from: PATTER: Basic flight maneuvers for Civilian Pilot Training. (1st ed.) Washington, D. C.: C.A.A. Division of Research, 1942. This version was prepared by E. Lowell Kelly and staff at Purdue University.)

[4] Fundamentals of elementary flight maneuvers. Civil Aeronautics Bulletin No. 32, February 1943. Washington, D. C.: The United States Government Printing Office, 1943. (Adapted from: Fundamentals of basic flight maneuvers for Civilian Pilot Training. (Supplementary student material). (1st ed.) Washington, D. C.: C.A.A. Division of Research, 1942. This version was prepared by E. Lowell Kelly and staff at Purdue University.)

[5] Kelly, E. L. Special problems and aids in flight instruction. (Unpublished chapter of proposed text in Aviation Psychology.)

[5a] Kelly, E. L. Evaluation of present flight training [illegible]

The National Research Council Committee on Selection and Training of Aircraft Pilots was requested to assume the responsibility for preparing the contents and procedures of the 30-hour course in training methods and to administer the course to seven methods-instructors,[6] who were then assigned to the secondary instructor training centers, to teach the course to instructor-trainees. The course, as finally developed and given to methods-instructors at a 10-day Institute conducted in April 1943 at the University of Minnesota by Committee personnel, included 10 unit lesson plans, each covering from 1 to 7 hours of instruction. The plans and demonstration material for each lesson, as well as supplementary materials, were embodied in a manual entitled Lesson Plans for Training Methods Unit of the C.A.A.-W.T.S. Secondary Instructor Course.[7] This manual was supplied to each of the methods-instructors together with an Instructor's Kit containing the records, films, and other materials to be used by them in conducting the course at secondary instructor training centers.

Rationale of the course. The course represents an application to flight instruction of the outcomes of educational and industrial research on the learning and teaching processes, and of the results of findings from pilot training research conducted by the Committee on Selection and Training of Aircraft Pilots. It undertakes to achieve an integration and organization of these established principles and research findings in such a manner as to furnish practical and effective guidance to instructors. This is done without reference to academic "psychology"; with an absolute minimum of technical terminology; and with repeated and specific reference to the flight situation.

Of particular interest in the construction of unit lesson plans is the use of the results of research sponsored by the Committee since 1939 with funds provided by the Civil Aeronautics Administration. Many of the supplementary reference materials and the training aids were taken directly from Committee investigations. Equipment and results developed in selection and training studies; in investigations of tension, fatigue, airsickness, personality, and coordination; and developments in techniques of standardized instruction represent the basic content of the unit lesson plans and reference materials of the training methods course.

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[6] The men who are studying to be instructors are referred to as instructor-trainees. The seven men who conduct the course in the Theory and Techniques of Flight Instruction at pilot instructor training centers are referred to as methods-instructors.

[7] Civil Aeronautics Administration War Training Service Lesson Plans for Training Methods Unit. Issued by the National Research Council Committee on Selection and Training of Aircraft Pilots in cooperation with the Division of Research of the Civil Aeronautics Administration.

The unit lesson plans are listed on Chart I and presented in detail on pages 1-107. A few illustrations may serve to indicate the manner in which basic psychological principles and the outcomes of research sponsored by the Committee on Selection and Training of Aircraft Pilots have been integrated with the problems of flight training to produce this course in training methods for pilot instructors.

The significance of practicing only correct methods of piloting. A basic principle of efficient learning is that the trainee must be taught and must practice only correct methods of work. The significance of this principle, and the manner in which it is frequently violated, can be illustrated from the experience of one of the authors[8] in learning to run a street car as a preliminary to the development of an improved program of selecting and training motormen. The customary pattern of training, at the time the analysis was made, was to send the apprentice out with a different motorman each day for a period of 10 days. It became quickly apparent that each of the motormen under whom the apprentice took training had his special "tricks," that is, individual ways of manipulating the controller and air-brake handles. For handling the air-brake, for example, one motorman recommended taking "long bites" of air, another, "short bites." One man employed one technique, involving one series of muscular actions for closing the door and starting the car simultaneously; another had a second method, involving another, almost antagonistic series of muscular responses. The total effect was to create interference in habit formation -- a condition which retards the development of skill, lengthens the training periods, and promotes an uncertainty of response which continues after the close of the training period.

In flight instruction, too, each instructor has his own particular way of explaining and performing a maneuver, and the nature of instruction given to groups of student pilots varies with the characteristics and habits of instructors. This has been adequately demonstrated in recordings, by E. L. Kelly,[9] of instruction as given in the plane, samples of which are included in the Instructor's Kit. By reference to these recordings of flight instruction, by the use of motion pictures of flight performance,[10] and by teaching instructor-trainees how to use the standard PATTER and Fundamentals of Basic Flight Maneuvers it has been possible to emphasize the importance of uniform instruction in the development of pilot skill and to point out how such uniformity can be attained. In Unit Lesson Plan II and throughout the other unit lesson plans there are references and applicatory exercises which show how the instructor may place into operation the basic principle that the trainee must be taught and must practice only the acceptable method of performing maneuvers.

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[8] Viteles, M. S. Science of work. New York: W. W. Norton and Company, 1934.

[9] The method of recording is described in: Kelly, E. L. The flight instructor's vocabulary. Washington, D. C.: C.A.A. Division of Research, Report No. 20, September 1943.

[10] Prepared and analyzed by the authors on the basis of procedures developed by Viteles and Thompson. See Viteles, M. S. & Thompson, A. S. The use of standard flights and motion photographs in the analysis of aircraft pilot performance. Washington, D. C.: C.A.A. Division of Research, Report No. 15, May 1943.

CHART I

TOPICS IN TRAINING METHODS UNIT

Unit Lesson Plan No.	
I	Introduction
II	Directed Learning
III	How Trainees Learn
IV	Adapting Training to Individual Trainees
V	Keeping the Trainee Interested
VI	Keeping the Trainee Fit
VII	Steps in Teaching a Trainee to Fly
VIII	Finding out How the Trainee is Progressing
IX	Checking Flight Instructor Practices
X	Summary of the Course

Characteristics of the learning process. Laboratory and industrial studies have revealed certain characteristics of the learning process which should be understood by the instructor in order that his instruction may be most effective. Almost every experiment involving the learning process has demonstrated that in the acquisition of bodily skills, particularly of a complicated nature, there are certain periods (called "plateaus") during which apparently no progress in learning is made by the pupil. The discussion of How Trainees Learn, in Unit Lesson Plan III of the Training Methods Course, brings this fact to the attention of pilot instructors and lays the basis for a more sympathetic understanding and effective approach during the "plateau stage" of learning -- a time when an instructor who is unaware of the normal progress of learning may be inclined to question the intelligence of a trainee, to criticize him for inaptitude, or to condemn him for obstinacy in refusing to learn.

The effect of "praise" and "reproof" and of "knowledge of results." Another example of the application of well-established principles of learning in flight instruction is to be found in the discussion of "reproof" and "praise" and of "knowledge of results" in stimulating trainees to good performance. At first glance, a study by Hurlock[11] frequently referred to in the literature on the psychology of learning, might seem to be of only academic interest to practical pilot instructors. In this experiment school children were required to practice arithmetical computations. Three groups of children worked together in a single room. Those in one group all received praise at the beginning of each session; those in the second group were all reproved for their failure to make progress; those in the third group were completely ignored. Almost uniformly the students who were praised improved at a much faster rate than those who were reproved, while those who were ignored remained consistently at a lower level in their performance of simple arithmetical computations.

An analysis of reports by student pilots shows that the most consistent complaint of practically all student pilots is that the instructor is extremely reticent in offering praise or encouragement, while there is an almost uniform tendency to "bawl out" the student for his faults.[12] The discussion of experiments such as those conducted by Hurlock, and also of studies showing the advantages accruing from keeping students informed of their progress, as included in Unit Lesson Plan V, Keeping the Trainee Interested, provides pilot instructors with a background of knowledge and specific references to methods which can be extremely helpful in improving the quality of training.

Need for a systematic approach. Apart from the content of materials of instruction is the need for systematizing the instructor's approach in handling every unit or every period of instruction. The common tendency, especially among those who have no training in educational methods, is to let the period of instruction take care of itself. Studies by Kelly[13] have indicated that frequently the first words of an instructor at the beginning of a flight lesson were, "Well, what did we do the last time?" This would seem to indicate that many instructors have no well formulated plan to adapt their training methods to the needs of particular trainees.

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[11] Hurlock, E. An evaluation of certain incentives used in school work. J. educ. Psychol., 1925, 16, 145-159.

[12] Kelly, E. L. Evaluation of present flight training methods. Op. cit.

[13] Kelly, E. L. Special problems and aids in flight instruction. Op. cit.

Actually, good instruction begins long before the instructor and trainee get together. It begins with a Statement of Aims in which the instructor clearly formulates for himself what he hopes to accomplish in the lesson. There follows a period of careful Preparation, in which the material to be taught is carefully reviewed, and the time distribution for topics to be discussed during the periods of ground and air instruction is planned in advance. This is followed by an organized Presentation, Directed Try-out, Supervised Practice, an integrated Review of what has been done, and a careful Evaluation of student accomplishment.

The experience of the War Manpower Commission in the operation of a Training-Within-Industry program[14] has demonstrated that the application of these simple steps of the lesson plan by foremen responsible for training produces enormous results in the way of increased production and of improved quality of work on the part of new and up-graded employees. Flight instructors, too, must comprehend the importance of these steps which have been outlined with specific reference to flight instruction in Unit Lesson Plan VII, Steps in Teaching a Trainee How to Fly, and in Unit Lesson Plan VIII, Finding out How the Trainee is Progressing. These lesson plans include applicatory exercises in which the instructor-trainees prepare generalized lesson plans for maneuvers. They also consider the use of various methods of evaluating the proficiency of trainees. Phonograph records of instructional procedures drawn from experiments by Kelly[15] are used as demonstrations, as well as motion photographs of good and poor piloting performances.[16]

Explaining in advance what is to be done. Throughout the course emphasis is placed upon the use of Fundamentals of Basic Flight Maneuvers, originally prepared by E. L. Kelly under the auspices of the Committee, and later published as a bulletin by the Civil Aeronautics Administration.[17] Experimental and logical justification for this instrument is found in experiments such as that conducted by Cox,[18] an English investigator, who showed that even on a simple assembly job it was possible to improve production by telling workers in advance why the job was done in a particular way and why and how certain tools were used. Employees given such directed instruction managed to achieve in 40 trials a level of production which was reached only after 300 trials by another group, matched for aptitude with the first group, which was simply given an opportunity to practice the task in a routine way without such preliminary instruction.

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[14] Job instruction, a manual for shop supervisors and instructors. Washington, D. C.: War Production Board. (For sale by Superintendent of Documents.)

[15] Kelly, E. L. The flight instructor's vocabulary. Op. cit.

[16] Prepared and analyzed by the authors on the basis of procedures developed by Viteles and Thompson. See footnote 10.

[17] Fundamentals of elementary flight maneuvers. Op. cit.

[18] Cox, J. W. Manual skill: Its organization and development. Cambridge: The University Press, 1934. Pp. xx & 247.

In Unit Lesson Plan II, Directed Learning, (as well as in Unit Lesson Plan VII, Steps in Teaching a Trainee How to Fly), there is presented a discussion of the effectiveness of directing trainee practice, a procedure which may well be neglected by the instructor unless he is exposed to the kind of training and becomes familiar with the type of material which have been included in the training methods course. Practical examples of mistakes in flying technique are presented by means of motion photographs, and instructor-trainees are required to outline the types of directed training they would suggest so that these errors might be overcome.

Significance of the course. On the shoulders of the pilot instructors of this country has been placed an enormous responsibility. Each good instructor multiplies himself a thousand-fold in serving the war effort. Each poor instructor adversely affects to the same extent this enormous undertaking in which we are involved. The course in training methods for pilot instructors provides qualified pilots with the facts and tools which they must have to become effective teachers. The course, in other words, is dedicated to the objective of helping instructors of the War Training Service establish and maintain the highest possible standard of pilot training as their distinctive contribution to the war effort.

II. ADMINISTRATION OF AN INSTITUTE FOR METHODS INSTRUCTORS[19]

Location of the Training Methods Institute. As indicated earlier, the course in training methods for pilot instructors was first given to methods-instructors who were then assigned to give the course to instructor-trainees at seven centers engaged in training pilot instructors. The University of Minnesota was selected as the location for a Training Methods Institute to which men from each C.A.A. region in the country were sent for special training as instructors in the methods course. The University made available facilities for classroom work and cooperated to the fullest extent in all respects. The course was administered by R. Y. Walker, Director of Training, Committee on Selection and Training of Aircraft Pilots, with the aid of E. S. Ewart, Technical Assistant.

Purposes of the Training Methods Institute. The purposes of the Training Methods Institute were two: First, it was considered necessary that the men who were to teach the course be given an indoctrination as to its content, be given insight into the background of its development, and be trained in the use of the Instructor's Manual and of the demonstration materials included in the Instructor's Kit. Second, and of equal importance, it was deemed essential that the course be given a try-out in the field, and be subjected to the criticism of a number of men having extended experience in flight instruction, before being administered to some thousands of instructor-trainees.

Qualifications of Methods Instructors. The requirements established in selecting men to attend this Institute and, following it, to teach the course in the instructors' school in their regions, were as follows:

a. An instructor's license and a minimum of 50 hours of experience as a flight instructor.

b. One year's teaching experience at the high school or college level.[20]

c. A minimum of one course in elementary psychology or one education course during college training.

An analysis showed that all of the men finally selected as methods instructors had entered aviation after having specialized training in college and in other professional fields. One man had been an electrical engineer; another one held a law degree; a third was a research chemist; a fourth an aeronautical engineer; a fifth a college physics instructor; the remaining two had been trained as teachers. They were well aware of the improvement

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[19] Prepared by R. Y. Walker, Ohio State University, Director of Training, Committee on Selection and Training of Aircraft Pilots.

[20] This requirement was waived in only one case, where one of the men selected had not had teaching experience in high school or college but had had 1500 hours of flight instruction experience.

in flight training that had taken place under the Civilian Pilot Training and War Training Service programs and were equally aware of the improvements that could yet be made in training methods.

Organization of Classroom and Field Work at the Institute. The Chairman of the Committee on Selection and Training of Aircraft Pilots opened the Training Methods Institute with general introductory remarks, discussing the background of industrial psychology and the application of industrial psychology to flight training.[21] After the first day the thirty hours of the course were so scheduled that all class work, insofar as possible, would be conducted in the morning, leaving the afternoons free for field work. When conditions permitted, the members attending the Institute gained experience in the use of instruments for evaluating flight performance by doing actual air work in a light training plane furnished by the W.T.S. Supervisor for the Third C.A.A. Region.

The unit lesson plans from which the instructor-trainees were later to teach at their schools were followed closely in terms of order of topics,[22] order of presentation, discussion, and time allotted to each topic. During the Institute, lesson plans for maneuvers were prepared, instruments for evaluating progress in flight training were used under actual flight conditions, and all other projects were undertaken by the methods instructors which they would later require their instructor-trainees to perform.

During the Institute the methods instructors prepared outlines of lesson plans covering flight maneuvers. Men were selected from the class, one to serve as the instructor and one to serve as a trainee. The individual serving as instructor then presented in sequential order to his trainee the successive steps of a flight lesson following his lesson plan and using the correct terminology for teaching a new maneuver to the trainee. Following this demonstration all members of the class participated in a general review and criticism of the lesson plan prepared by the instructor and his method of presenting the maneuver to the trainee.

Methods for evaluating flight performance of a trainee were also practiced by the class. The rating devices used were the W.T.S. Flight Instructor's

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21 See Appendix C, Introductory Remarks, by M. S. Viteles, a reprint of opening remarks by the Chairman of the Committee on Selection and Training of Aircraft Pilots delivered before the War Training Service Institute on Training Methods in Minneapolis, Minnesota, April 1943.

22 With the exception that unit lesson plans on Steps in Teaching the Trainee How to Fly and Finding out How the Trainee is Progressing were taken up first, in order that air work in connection with these units could be done during the time of the Institute, making allowances for bad flying conditions.

Recommendation Form 342A,[23] and the Ohio State Flight Inventory.[24] Methods-instructors were paired and flight schedules arranged so that one individual could serve as a trainee while the other served as observer. A short experimental flight of six maneuvers was set up to be used for checking flight evaluation methods. Each person serving as a trainee was asked to insert into each maneuver of his experimental flight two errors commonly made by beginning trainees, taking care that the exact nature of the errors was not known by the observer beforehand.

Each person serving as trainee[25] then made two successive flights so that the observer would be able to use the two different aids for evaluating flight performance. The observer was instructed to mark all errors noticed during the experimental flight on the particular evaluation form he was using. Following completion of these two flights the trainee and the observer then exchanged positions and made two additional flights, the former observer now serving as trainee and the former trainee now serving as observer. Upon completion of all the experimental flights a comparison was then made between the errors noted by the observer and the errors intentionally made by the individual serving as trainee.

Revision of unit lesson plans. One important objective of the Training Methods Institute was to revise the unit lesson plans in the light of the experience gained in this first presentation of the material to the methods-instructors. To this end, complete stenotype notes were taken of the class presentations and discussions. Furthermore, methods-instructors were encouraged to offer suggestions for the improvement of the course. At the end of each day the staff members at the Institute reviewed the outline of the material which had been presented during that day, preparing a list of revision proposed by the methods-instructors or by themselves. These suggestions were sent to the other members of the Committee staff, at the University of Pennsylvania, who made use of these suggestions and of the stenotype notes in preparing the first revision of the unit lesson plans for immediate use in the field. It is this first revision which is presented in the present report.[26]

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[23] Flight Instructor's Recommendation or Pilot Flight Test Report. Form ACA-342A. Washington, D. C.: Civil Aeronautics Administration, 1942.

[24] See: Manual for the administration of the "Ohio State Flight Inventory." (1st ed.) Washington, D.C.: C. A. A. Division of Research, March 1943. (Draft version, unreleased.)

[25] Editor's Note: It is, of course, recognized that optimal results in training pilot instructors require that instructor-trainees practice instruction on student pilots. It is hoped that existing C.A.A. regulations can be modified to make this possible.

[26] It is recognized that further revision may be desirable, especially as new research findings and suggestions from instructors in the field are available.

Evaluation of the Institute by the methods-instructors. Those attending the Institute recognized the similarity in problems of learning existing in the simple laboratory demonstration and in the flight situation. The discussion of psychological problems that an instructor encounters while teaching trainees elicited considerable interest and response from the methods-instructors. They were generally aware, for example, of the problems of motivation and emotional stability existing in flight training, but had not given any systematic consideration to such problems.

Demonstration material, such as the phonograph records and motion-picture films included in the Instructor's Kit, brought out very clearly particular points emphasized in the outline and "pointed-up" the specific problems in a fashion that was readily recognized by all those attending.

Practice work in the preparation of a flight lesson was a new experience to most of those attending the Institute. The common procedure in the field of going up for a flight lesson with no preparation on the part of the instructor has been a more or less accepted procedure as observed by those in attendance at the Institute.

Methods for evaluating flight performance received favorable attention and elicited considerable discussion on the part of the experienced flight instructors attending the Methods Training Institute. The majority of them felt that among the most difficult problems for the beginning instructor are the recognition of errors in flight performance and the adequate evaluation both of specific aspects of performance and of over-all flight performance. The use of an evaluating instrument such as the W.T.S. Form 342A or the Ohio State Flight Inventory as a teaching aid was considered by those attending the Institute to have significant value. The recommendation and method embodied in Unit Lesson Plan IX for a periodic check-up by the instructor on his teaching practices were also enthusiastically received. The methods-instructors seemed well aware of the fact that teaching elementary students to fly can become a very boring task with a resultant deterioration in the flight instructor's teaching method, and quickly recognized that a periodic self-audit is necessary for any instructor who hopes to maintain good standards of teaching.

Operation of the course in the field. The methods-instructors were assigned by the War Training Service to the following schools, at which the Controlled Secondary Instructor Course was centered. Instruction in training methods is now being given by the methods-instructors to successive classes of instructor-trainees at each of these centers.

Pathfinder Flying Service, Carson City, Nevada
Chanute Junior College, Chanute, Kansas
University of Minnesota, Minneapolis, Minnesota
Portland Flying Service, Prineville, Oregon
Hardin Junior College, Wichita Falls, Texas
Danville Military School, Danville, Virginia

In several cases, methods-instructors are also teaching the 18-hour ground course on flight instruction required of the contractor. In such instances

the 18-hour course provides time for "practice teaching" the instructor-trainees who place into actual operation the course material in preparation of lesson plans, instructional methods, and evaluation methods.

If the effect of the Institute on the future of flight instruction can be judged by the response of those attending, there is no question but that it will result in improvements in practices followed in training pilots. It is hoped that the start that has been made in this line can be followed up as new or improved techniques are developed as the result of further research by the Committee on Selection and Training of Aircraft Pilots and by other groups.

III. UNIT LESSON PLANS OF THE COURSE IN TRAINING METHODS FOR PILOT INSTRUCTORS

Unit Lesson Plans. In the following pages are the Unit Lesson Plans, First Revision, exactly as they are included in the Instructor's Manual.[27] In the field certain modifications of or deviations from these lesson plans are necessary in order to comply with the training schedule in a given center. In general, however, the methods-instructors have been directed to follow the outline as closely as possible.

The reference materials called for in the various Unit Lesson Plans, and included in the Instructor's Manual, are listed in Appendix A. These materials were presented as an Appendix to the lesson plans and assembled according to the unit lessons with which they were to be used. It will be noted that the entire set of these reference materials is not presented in this report. However, a number of representative items have been included as exhibits, in Appendix C, including primarily those materials which cannot readily be obtained from other sources or which are not already published in other reports.

As a further aid to presentation and demonstration in the classroom, an Instructor's Kit was prepared to supplement the reference materials given in the Instructor's Manual and the information given in the Unit Lesson Plans themselves. A list of the materials included in this Kit is presented in Appendix B. These materials included items which could not be conveniently inserted in the Instructor's Manual (such as phonograph records), certain materials which had complete and separate publication elsewhere (e.g., C.A.A. Bulletins), and certain mechanical training aids (e.g., aero-trainer).

The bibliography and sources of all references and materials appearing in the Instructor's Manual and the Kit are also presented in the Appendix.

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27 In the Instructor's Manual, sheets headed "NOTES" were inserted between successive sheets of each Unit Lesson Plan for the instructor's convenience in noting certain points which he wished to bring out in connection with sections of the printed outline. These sheets have been omitted in this report.

CIVIL AERONAUTICS ADMINISTRATION
WAR TRAINING SERVICE

Controlled Secondary Instructor Course

OUTLINE OF TOPICS IN TRAINING METHODS UNIT

UNIT LESSON PLAN I. INTRODUCTION

Organization of the class 1
Demonstration of common errors in flight instruction . . . 3
Common beliefs in flight instruction 6
Objectives of the training methods unit 7
Preview of the course as a whole 7

UNIT LESSON PLAN II. DIRECTED LEARNING

Discussion of the definition of "flying time" 8
What has been learned about flight instruction from studies of air-ground time 9
Implication of air-ground time studies for instructors . . 10
Discussion of directed vs. undirected learning 10
Implications of industrial experiments for flight instruction 11
Aids for directed learning in flight instruction 12
Try-out and practice (Analysis of a motion photograph of a 360° Steep Turn) 13

UNIT LESSON PLAN III. HOW TRAINEES LEARN

Directions for the card-sorting experiment 14
General characteristics of the learning curve 16
Similarity between common characteristics of the learning curve and learning to fly 17
Random fluctuations 17
Plateaus in learning 17
Reversals in learning 19
Other factors affecting learning rate 20
Teaching too much too fast 20
Transfer of learning and development of habit sequences 20
Training aids (advantages and disadvantages) 23

UNIT LESSON PLAN IV. ADAPTING TRAINING TO INDIVIDUAL TRAINEES

Individual differences in learning (card-sorting experiment) 25
Trainee differences: 26
In basic physical characteristics 26
In "intelligence" 27
In background 27
In appearance and personality 27

Characteristics of trainees encountered during flight instruction 28
Discussion of the trainee who is a "slow-starter" 28
Dangers in "typing" individuals 30
Treating trainees individually 31

UNIT LESSON PLAN V. KEEPING THE TRAINEE INTERESTED

Motivation in learning to fly 33
Methods of keeping the trainee interested
Setting goals for the trainee to shoot at 34
Keeping the trainee informed of his progress 34
Use of praise and reproof in motivating the trainee . 35
Handling the overconfident and underconfident trainee
The overconfident trainee 37
The underconfident trainee 38
Other methods of motivating the trainee and maintaining his interest
Developing a feeling of "group responsibility". . . . 39
The use of "pep-talks" 40
Instruction from the trainee's viewpoint 40

UNIT LESSON PLAN VI. KEEPING THE TRAINEE FIT

The instructor's responsibility for trainee fitness 44
Colds and other common ailments 45
Effect of drugs on flying ability 46
Air sickness 46
Fatigue 48
Meaning of "tension" 50
Emotional reactions 52
Causes of emotional maladjustment 53
Ways to recognize emotional disturbance 53
The instructor's part in maintaining trainee's emotional balance 54
Preparing the trainee for his first dual flight 56
Preparing the trainee for his first solo flight 57
Preparing the trainee for his final test flight 58
Preparing the trainee for acrobatics and simulated emergencies 59

UNIT LESSON PLAN VII. STEPS IN TEACHING A TRAINEE TO FLY

Major steps in teaching 63
Application of these steps to flight instruction 63
Aim of the lesson 63
Preparation 64
Presentation and demonstration by the instructor . . 65
On the ground 65
In the air 66
Try-out and practice by the trainee 66
Review and evaluation 67

Application of these steps to solo instruction 67
Application of these principles to the teaching of Medium Turns 69
Class demonstration of the principles 73

UNIT LESSON PLAN VIII. FINDING OUT HOW THE TRAINEE IS PROGRESSING

Need for accurate measure of pilot performance 79
Sources of error in judging performance 79
Requirements of an accurate measure 81
Standardization of flight instruction in general 82
Standardization of C.A.A.-W.T.S. tests 82
Use of standard flights in flight instruction 82
Reduction of errors of observation and evaluation 84
The problem of rating flight performance 85
Major purposes of ratings 89
The "Ohio State Flight Inventory" 89
Photographic method of analysis of flight performance . . . 93
Graphic recording of pilot performance 94
Comparison of Logbook and Flight Inventory observations . . 96

UNIT LESSON PLAN IX. CHECKING FLIGHT INSTRUCTOR PRACTICES

Need for periodic check-up of instructor's teaching practices 98
Methods of checking on instruction practices:
The U.S. Navy "Diagnostic Scale for Rating Flight Instructors" 99
The "Self-Audit" for flight instructors 99
Value of informal appraisal of instruction practices by the trainees 101

UNIT LESSON PLAN X. SUMMARY OF THE COURSE

"25 Opinions on Flight Instruction" 102
Eleven "Points to Remember in Flight Instruction" 102
General discussion of each of the eleven points 103
Further needs for the improvement of flight instruction . . 106
The function of research in the improvement of flight instruction 106
Contribution of the flight instructor to the war effort . . 107
Responsibilities of the flight instructor 107

FINAL EXAMINATION IN THE COURSE

INTRODUCTION

Unit Lesson Plan I (First Hour)

I. AIMS OF LESSON

A. To establish initial contacts and rapport with the class.

B. To indicate the need for an instructor-training course.

C. To explain the objectives and present an over-all view of the course.

II. MATERIALS

☐ Phonograph.
☐ Phonograph Record 1, Selections A and B.
☐ Copy for each Instructor-Trainee of "25 Opinions on Flight Instruction" adapted from the U. S. Navy form.

Reference materials (in notebook):

☐ "U. S. Navy Opinions on Flight Instruction."
☐ "25 Opinions on Flight Instruction."
☐ "Patter for Elementary Flight Maneuvers."
☐ "Fundamentals of Elementary Flight Maneuvers."
☐ "The Story Behind the Patter."
☐ "The Flight Instructor's Vocabulary."
☐ Transcript of Phonograph Record 1, Selections A and B.
☐ "Sample Student Comments."
☐ "Introductory Remarks" at opening session of the Institute at Minneapolis.

III. PREPARATION

A. Assemble materials in the order in which they are to be used in Unit Lesson Plan I. Place a check in the proper square above when each piece of material is obtained.

B. Review phonograph records and reference materials.

C. Select several questions from "25 Opinions on Flight Instruction" for class discussion, e.g., Nos. 1, 6, 9, 14.

D. Be there ahead of time. Arrange setting to reduce "class-room" atmosphere as much as possible.

IV. PRESENTATION AND DEMONSTRATION

A. Opening remarks by W.T.S. representative, stressing:

1. Importance of the position of "flight instructor" and the responsibilities resting on flight instructors.

2. Need for efficient flight instruction in the successful prosecution of the war.

3. Need for viewing "flight instruction" as a profession rather than "just a job for the duration."

B. Introduction, by W.T.S. representative, of the flight operator and the methods-instructor.

C. Brief remarks by flight operator, indicating that "his turn" will come later and that the increase in efficiency of flight instruction "on the field" will depend upon how much the instructor-trainees get out of this course.

D. Opening remarks by methods-instructor.

1. Break the ice and establish rapport with the group.

2. Refer to W.T.S. representative's remarks and re-emphasize goal of "Best Pilots in the World in the Largest Number in the Shortest Possible Time."

a. Emphasize the fact that flight instructors contribute more to a successful prosecution of the war by training thousands of <u>good pilots fast</u> than they would if they were to go into combat themselves. (See "Introductory Remarks.")

3. Course designed to help instructors achieve the above goal by:

a. Acquainting them with the best methods of instruction and with available aids to instruction.

b. Pointing out errors in flight instruction and how they may be avoided.

> CAUTION: Do not present an extended description of the course at this point. A <u>detailed</u> discussion of the objectives and a preview of the course as a whole are provided for during the second hour of Lesson I.

4. Course is based upon a survey of the methods now used by instructors and upon research carried out for the C.A.A. by the National Research Council Committee on Selection and Training of Aircraft Pilots. (See items on research, "Introductory Remarks.")

5. The course is set up so as to "pass on" to beginning instructors the wealth of experiences of past and present instructors. "What has worked" and "what seems promising" will be stressed.

6. Much of the past and present research in the field of flight instruction has been made possible through the cooperation of flight instructors in the field. "You, as instructors, will be able to contribute to future research."

7. Point out that it is desirable for the men in the field to maintain contact with each other and to exchange examples and ideas among themselves. Remind each of them to include the Office of the methods-instructor in his mailing list.

E. Demonstration of common errors in instruction.

1. Introductory remarks, pointing out:

a. That there are right and wrong ways to teach, just as there are right and wrong ways to fly.

b. That we have permanent records of "what went on" during a number of actual instruction lessons by experienced instructors. These recorded instructions illustrate how these men faced some of the problems which will soon confront each of these instructor-trainees.

2. Brief description of how phonograph recordings were obtained as part of the N.R.C. research program. (Methods-instructor -- see "The Story Behind the Patter" and "The Flight Instructor's Vocabulary." Stress the fact that the records are not altogether clear, but they show how conversation between instructor and pilot frequently sounds during flight.)

3. Play Phonograph Record 1, Selections A and B.

a. After each record ask the class what good and poor methods of instruction they observed in the recordings.

b. Classes will generally comment on the following points:

(1) Record 1, Selection A:

(a) Instructor is over-critical of the trainee.

(b) The instructor gives no constructive suggestions, never points out why a thing is wrong.

(c) The instructor's attitude and tone of voice tear down the trainee's self-confidence.

(d) The instructor did not plan his instructions.

(e) The instructor can't be understood. (Point out the need for compensating for the noise of the plane.)

(2) Record 1, Selection B:

(a) Instructor's attitude and tone of voice are good. He is calm at all times.

(b) Instructions were probably planned. They are clear and to the point.

(c) The instructor and the trainee seem to be working "as a team."

(d) The instructor praises or compliments the trainee on his performance, in addition to pointing out and demonstrating his specific errors.

(e) Instructor uses a little humor to relieve the tension.

4. Read "Sample Student Comments" to the class. Ask the class what the Student Comments illustrate. The items mentioned will probably include:

a. Some of the items noted under '3' above.

b. Instructor's directions not specific enough.

c. Instructor "rides" student on one fault.

d. Student felt "misunderstood," or "picked on."

5. Point out that "Patter" and "Fundamentals" can be used, in part, to insure that the instructor will tell properly how to perform maneuvers.

> CAUTION: This discussion of "Patter" and "Fundamentals" is merely to point out <u>where</u> they are used. Do not give a detailed description of them at this time, as they are treated more fully in a later lesson.

a. "Patter" is to be used as a guide for instructing the trainee while in the air. It tells the instructor what to say and how to say it.

b. The "Fundamentals" is to be used in the ground instruction.

(1) Point out the value of giving the trainee a thorough understanding of the basic information.

(2) Stress the fact that the trainee must be given definite assignments in "Fundamentals" at the end of every lesson. The instructor should point out the essentials or points to be emphasized.

(a) For review of the lesson just given.

(b) For study before the next lesson is begun.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan I (Second Hour)

If there has been an extended lapse of time between the first and second hours of this lesson, present a brief summary of the topics discussed during the first hour.

(1) Answer questions raised by the class, if any.

(2) Introduce second hour of the lesson.

IV. PRESENTATION AND DISCUSSION (Continued)

F. Common beliefs in flight instruction.

1. One of the difficulties in discussing flight instruction methods is the considerable difference of opinion among flight instructors as to common practices. Instructors tend to develop "pet" beliefs and strong prejudices.

2. Have the members of the class fill out the "25 Opinions on Flight Instruction." Ask them to make the ratings on the basis of their flight experience to date. (This will require about 15 minutes.)

a. Point out that the "25 Opinions on Flight Instruction" was selected and adapted from the "U. S. Navy Opinions on Flight Instruction."

b. Each item on the "25 Opinions on Flight Instruction" will be answered by writing 1, 2, 3, 4, or 5 in the box opposite the appropriate question.

c. These "25 Opinions on Flight Instruction" are to be kept by the instructor-trainees. They will be used again in the Unit Lesson Plan X.

3. Discuss sample items Number 1, 6, 9, and 14 from the blank and make an informal check as to how these items were rated by the class. For purposes of class discussion the methods-instructor may use other items selected from the "25 Opinions on Flight Instruction" or the "U. S. Navy Opinions on Flight Instruction." Stress the following points:

a. There are differences of opinion among members of the class on such items.

b. Opinions are stronger on some items than others.

c. Specific evidence is needed to substantiate the opinions expressed by the class. (Bring in supporting comments which will serve as "evidence" for the opinions given

by the class on these items.)

d. At this time we are interested primarily in getting the instructor-trainees to realize that there are these differences and to emphasize the point that each instructor-trainee must carefully review and criticize his own beliefs before inflicting them on a trainee.

G. Present the objectives of this course. This course is being given to help instructor-trainees avoid errors such as those noted above as well as others to be discussed later in the course. In general, the course is designed to do the following:

1. To present basic principles of instructing which instructor-trainees adapt and apply in their own specific instruction situations.

2. To aid instructor-trainees in answering for themselves the many questions which will arise when they are instructing in the field.

3. To evaluate various techniques employed in flight training and to provide information on best methods of instruction as gleaned from past experience of instructors and from current research.

4. To provide opportunity for practice teaching both on the ground and in the air so as to develop good habits of instruction.

5. To standardize methods of instruction so that instructors can teach at any airport in the country. (See example of training motormen in "Introductory Remarks.")

H. Give a preview of the course as a whole, briefly describing the major topics to be discussed with one or two sample sub-topics of each. (Refer to Outline of Course.)

V. REVIEW AND CONCLUSION

A. Concluding Summary of Unit Lesson Plan I.

1. Need for efficient, trained instructors.

2. Samples of common errors made during instruction.

3. Common beliefs of instructors.

4. Objectives of course.

B. Brief statement concerning next session.

DIRECTED LEARNING

Unit Lesson Plan II (First Hour)

I. AIM OF LESSON

A. To demonstrate the value of "directed learning" as compared with "mere repetition."

II. MATERIALS

- ☐ Phonograph.
- ☐ Phonograph Record 2, Selection A.
- ☐ Motion picture projector and screen.
- ☐ Motion photographs of 360° Steep Turns, Reel 1.
- ☐ Copies for the class of sheets from the "Ohio State Flight Inventory" for rating Steep Turns.
- ☐ "Manual for the Administration of the Ohio State Flight Inventory."

Reference materials (in the notebook):

- ☐ Photograph and description of Servis Recorder.
- ☐ Description and analysis of motion photographs of 360° Steep Turns, Reel 1.
- ☐ Transcript of phonograph record 2, selection A.
- ☐ "Fundamentals of Elementary Flight Maneuvers," pages 12-15 inclusive.
- ☐ "Fundamentals of Secondary Flight Maneuvers."
- ☐ "Analysis of Eye Fixations and Patterns of Eye Movement in Landing a Piper Cub J-3 Airplane."
- ☐ "Introspective Reports on Learning to Pilot an Aeronca Chief Plane."
- ☐ "Study of Visual Depth Perception in Aviation."
- ☐ "General Principles of Learning."

III. PREPARATION

A. Review the Cox-Shaw studies ("General Principles of Learning," Section 3) and other reports listed above.

B. Review the motion pictures of Steep Turns, and pick out the points to be emphasized in the class demonstration.

C. Review the sample recordings of flight instruction.

D. Review the discussion of Medium Turns and Steep Turns in the "Fundamentals of Basic Flight Maneuvers."

IV. PRESENTATION AND DEMONSTRATION

A. Introduction.

1. The primary course in C.P.T. required that a trainee have a minimum of 35 hours of "flying time" before he was eligible for examination for a private license. The definition of this so-

called "flying time" has been called into question almost from the beginning of the research program:

a. "How much time do trainees actually spend in the air during this 35 hours of training?"

b. "What differences are there among the instructors with reference to the time they spend with the trainees in the air and on the ground during a standard instruction period?"

c. "What are the differences among trainees with respect to the time they spend on the ground and in the air?"

d. "How is the time spent on the ground consumed -- in instructing the trainees, in taxiing the plane, in unavoidable delays due to traffic conditions, etc., of the airport, or in malingering?"

B. Tell what has been learned about flight instruction from studies of time spent on the ground and in the air.

1. Describe the Servis Recorder (see description in reference materials) and indicate how it has been used to obtain a record of time spent in the air and on the ground during actual instruction sessions.

2. Studies involving the use of the Servis Recorder and other instruments have indicated that on the average at least 20% of the total lesson time logged as air work is spent on the ground. Airports, instructors, and trainees have been found to differ widely.

3. Studies have also shown that the average trainee makes only about 100 landings during his primary C.P.T. course.

4. Time spent on the ground may be influenced by any or all of the following:

a. Instruction and discussion of maneuvers -- a function of the instructor, and of the trainee's success in ground operations.

b. Taxiing and practice in handling the machine on the ground -- also a function of the instructor, and of the trainee's success.

c. Traffic conditions and delay by the tower, a function of the type of airport at which the instruction is given.

d. The trainee's motivation as measured by his "stalling," i.e., malingering on the part of the trainee, slow taxiing, etc.

e. Type of maneuver practiced, i.e., the trainee who has difficulty in learning to land will spend more time on this maneuver and thereby increase his ground time.

C. Discuss the implications of the air-ground time studies for flight instructors.

1. Since the total time in the air is relatively short (only about 28 hours of the 35-hour C.P.T. primary course), every minute must be used efficiently.

2. Every take-off and landing must count. The time on the ground must also be used efficiently. It should be an integral part of the total lesson time.

a. Stress the implications of "touch and go" landings. Point out the relative merits of "touch and go" landings versus complete landings which train the pilot in handling the plane on the ground and give valuable taxiing experience.

b. Discuss the accident rate for taxiing and how it is probably related to insufficient taxiing experience.

(1) Taxiing accidents rank second in order of number of accidents in W.T.S. pilots.

(2) Taxiing accidents can only be charged to inadequate instruction and carelessness on the part of the instructor and the trainee.

D. Present for discussion the question: "Is it better to spend 15 minutes on the ground before the lesson discussing landings and the trainee's errors in previous dual practice and then give him 30 minutes solo practice, or to send him up for 45 minutes landing practice without discussion?"

1. Develop the principle TIME SPENT IN EXPLANATION AND DISCUSSION ON THE GROUND IS NOT WASTED, IF OUTLINES AND ADEQUATE PRESENTATIONS ARE MADE.

2. State that while there is no experimental evidence with specific reference to flight training, research in industry on directed vs. undirected learning has shown conclusively the value of thorough discussion before practice.

E. Discuss directed vs. undirected learning.

1. Illustrate what is meant by directed and undirected learning by referring to the Cox-Shaw experiments. (See "General Principles of Learning," Section 3.)

2. Point out that the "training" group in the Cox-Shaw experiments were being given "directed learning" and that the "practice" group were learning merely through trial and error. Indicate advantages of the former type of instruction.

3. Essential technique of directed learning is to explain the underlying principles of the task to be learned and to make the elements of the task meaningful to the learner.

4. Studies on directed versus undirected learning illustrate the value of calling the attention of the learner (trainee) to specific cues which facilitate the learning of the correct performance (or maneuver). Refer to the last four items under "II. Materials."

F. Show the application of these industrial experiments to flight instruction.

1. Demonstrate the principles of directed learning as used in teaching a specific flight maneuver, e.g., Steep Turns.

a. Have the class discuss the following points which should be talked over with the trainee and the emphasis to be given to each in the "directed learning period," on the ground before the flight demonstration of Steep Turns.

(1) "Riding with the ship" so that slips or skids can be detected.

(2) The fact that violent control pressures are not needed to establish the bank -- normal aileron and rudder pressures merely being held longer.

(3) Dangers of holding top rudder to keep the nose up.

(4) Necessity of looking in all directions for traffic before beginning turn.

(5) Review of specific cues (reference points) which are useful in determining bank, altitude, recovery heading, etc., in performing Steep Turns.

b. Make clear that all points suggested need not be given before the first demonstration of the maneuver, but can be given to the trainee as his proficiency in the maneuver develops. Major points should be made first.

c. Indicate that it is important to call the trainee's attention to those points of the maneuver which he did correctly and to inform him accurately of his errors and how to correct for them. (This topic is stressed elsewhere in the course.)

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan II (Second Hour)

If there has been an extended lapse of time between the first and second hours of this lesson, present a brief summary of the topics discussed during the first hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

G. Aids for directed learning in flight instruction.

1. Play Phonograph Record 2, Selection A: a period of ground instruction. Allow time for comments by the class.

2. Discuss the use of "Fundamentals" as an aid in directed practice for all maneuvers, using the maneuver Steep Turns as an example.

   a. Point out that the instructor should first determine the trainee's familiarity with the assigned material. He should clarify points which are not clear to the trainee and develop those points which are particularly applicable to his problems.

   b. Make reference to "Fundamentals of Secondary Flight Maneuvers" when discussing the secondary maneuvers.

3. Bring up the point that directed learning also includes organization of a trainee's practice so that particular attention is given to correction of his weak points.

   a. When an error in application of a particular control is commented on be sure to explain to the trainee how this error affects the over-all performance of the maneuver.

   b. Contrast this procedure with merely telling a trainee who has been having difficulty with Steep Turns to go out and practice them. The latter procedure makes it possible that trainee will practice bad as well as good habits. Use a specific example.

4. Point out the use of the "Ohio State Flight Inventory" and other aids in diagnosing the inadequacies in a trainee's performance. Show how the Inventory might be marked for a given trainee. (Note that such aids are treated more fully in Unit Lesson Plan VIII, "Finding Out How the Trainee is Progressing.")

5. State that it is important for the trainee to have the opportunity to talk through with the instructor the factors making for good performance in a maneuver and the specific errors he has been making.

6. Instructor-trainees should understand that the aids discussed above apply to solo as well as dual practice periods.

V. TRY-OUT AND PRACTICE

1. Show the motion pictures of a trainee's performance on two 360° Steep Turns as a demonstration.

2. On the basis of the performance as exhibited in the photographs, tell the class to note what suggestions in terms of directed learning they would make to this trainee before sending him up for further solo practice of Steep Turns.

3. Run the film through two or three times, pointing out the readings of the instruments. (Indicate that in an actual situation other factors would be involved, e.g., a correct heading on recovery -- see Description and Analysis of Motion Photographs.)

   a. Class discussions will probably bring out such points as the following:

      (1) Not a Steep Turn; only 30° bank.

      (2) Slips on entry.

      (3) Varies in altitude.

      (4) Slips and skids during the turn, etc.

VI. EVALUATION AND REVIEW

A. Have members of the class evaluate the suggestions made during class discussion.

B. Relate the suggestions to the principles discussed in this period and the preceding period.

C. Stress again the superiority of directed learning over undirected learning.

Make brief summary of the topics discussed during this hour.

HOW TRAINEES LEARN

Unit Lesson Plan III (First Hour)

I. AIM OF LESSON

A. To demonstrate the application to flight instruction of certain general characteristics of learning with which good flight instructors should be familiar.

II. MATERIALS

- ☐ Phonograph.
- ☐ Phonograph Record 3, Selection A.
- ☐ Cards, watch, and graph paper for the Card-Sorting Experiment.
- ☐ Copy of "Procedures for the Card-Sorting Experiment" for each member of class.

Reference materials (in notebook):

- ☐ "General Principles of Learning."
- ☐ "Transcript of Phonograph Record 3, Selection A."

III. PREPARATION

A. Practice with the Card-Sorting Experiment yourself until you are thoroughly familiar with the operation of the experiment.

B. Read "General Principles of Learning" Sections 1-4, 8, 10.

C. As you read the references, make a list of examples from flight training which illustrate the principles outlined in these references.

D. Prepare class-room with suitable tables, etc., for Card-Sorting Experiment.

IV. PRESENTATION AND DEMONSTRATION

A. Card-Sorting Experiment.

1. Introduce the experiment with a statement such as: "Progress in learning to fly follows a pattern which is typical of learning in general. This general pattern of progress in learning a task can be illustrated by a short exercise which we are going to do in this session."

2. Hand out the "Procedures for the Card-Sorting Experiment" to each member of the class.

3. Run through the Card-Sorting Experiment, following the instructions and procedures as given in the "Procedures for the Card-Sorting Experiment." (If preparations have been adequate, this will take approximately 40 minutes.)

4. While the class is doing the experiment, draw a sample curve on the board. (See sample curve in second hour, p. 15.)

5. Hand out the graph paper and instruct them to plot their learning curves. Both members of a pair should plot the curve for their experiment. Make it clear that all 25 trials are plotted consecutively along the abscissa and time on the ordinate.

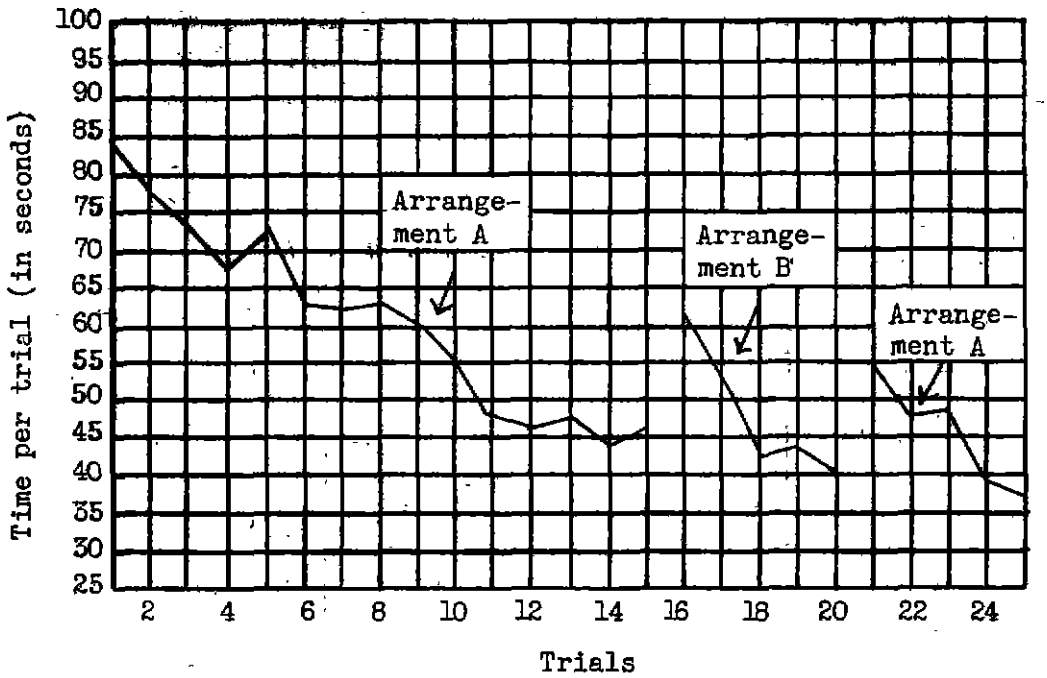
> NOTE: If the first and second hours of this class are separated by more than an "intermission," assign the plotting of these curves as an outside assignment. But be sure to point out how the curves should be drawn.

Unit Lesson Plan III (Second Hour)

IV. PRESENTATION AND DEMONSTRATION (Continued)

B. General characteristics of the learning curve.

1. Draw on the blackboard a representative learning curve as found in this experiment. Ask the class members to compare their learning curves for the Card-Sorting Experiment with the one drawn on the board.



Representative curves from the card-sorting experiment.

> CAUTION: Cover the points in B2, 3, and 4 in a general fashion, giving your class an over-all view of the topics. These points will be discussed in detail later.

2. Discuss briefly the following general characteristics of a curve of learning:

   a. Rapid improvement at first.

   b. Temporary plateaus.

c. Final leveling off.

d. Occasional reversals.

3. Describe the S-shaped curve in which rate of learning is slow at first, then rapid, and then slower as the curve gradually levels off. Point out that the slow initial improvement is due to "fumbling around" while getting oriented to the new task and that this type of curve occurs when the task being learned is quite new or different from anything done before. Flying may represent this kind of new experience to some individuals.

4. Point out that the over-all patterns of most of the basic maneuvers (climbs, glides, straight and level, and turns) are learned fairly well in the first 4 or 5 hours, or at least before solo, and the rest of the flight training is primarily a smoothing up of the execution of these maneuvers, and their combination into more complex maneuvers.

C. Develop in the class discussion the similarity between certain common characteristics of the learning curve presented on the board and common characteristics of learning to fly.

1. Put across the idea that many of the characteristics pointed out above are to be expected in any learning situation.

2. From reference to the class curves from the Card-Sorting Experiment bring out the following characteristics and their application to flight instruction.

a. Random fluctuations. Note on the learning curves of members of the class, that the curve is not smooth, and that although the general trend may be downwards, a given trial may be poorer than the preceding one. Develop the point that similarly, because a trainee's performance on his second or third trial of a recently introduced maneuver is worse than his preceding one, this is not a cause for alarm or recrimination. Such random fluctuations are to be expected.

b. Plateaus. This topic is important and should be emphasized. Unless this characteristic is brought up by the class, introduce it as follows:

(1) Ask the members of the class to think back to their own training experience, and to try to recall if any of them experienced periods in which their flying slumped (failed to improve for days at a time), and then suddenly went ahead normally or faster.

(2) Open for class discussion the question of the particular maneuvers in which this characteristic is

most evident. (Spot landings, normal landings, spins.)

(3) Then state that these periods are known as plateaus, and are a rather common characteristic of learning curves. Identify as many plateaus as possible in the learning curves from the experiment of the previous meeting.

(4) Mention certain of the causes and characteristics of plateaus, and show how these might easily arise in flight training. Use specific examples whenever possible.

(a) Point out that plateaus occur most frequently when complex or highly coordinated tasks are being learned. (For example, plateaus will be very evident during the learning of advanced acrobatics.)

(b) Mention that plateaus often are found when an individual has learned all but one of several parts of a total task and is concentrating on learning the one part left.

- While the trainee is learning this specific part, his performance on the entire task does not appear to improve, i.e., his over-all performance remains on a plateau. This is due to the fact that the trainee is not only learning to do a given part of the total performance correctly, but also he is at the same time trying to integrate this part with the rest of the task.

- For example: The trainee who is showing no observable improvement in his over-all performance of slow rolls. One of his difficulties might be with that part of the task involving application of forward elevator pressures. The student recognizes the need of forward pressure in holding the nose up during inverted flight but does not recognize the timing and pressures necessary on the elevators to maintain a constant heading. All other aspects of the control use may be correct. When this one difficulty is eliminated and its correct performance integrated with the other control applications the performance on the entire maneuver will show improvement.

(c) If the trainee does not understand why he seems to be showing no improvement on the over-all task he is apt to get discouraged. This dis-

couragement in itself tends to prolong the plateau. He must be shown where the specific difficulty lies and how, on its improvement, his over-all performance on the maneuver will be improved.

(5) Implications for flight training.

(a) Point out that plateaus are a common characteristic in the learning of any complex task, and that unless they are prolonged there is no cause for worry.

(b) Emphasize that anything the instructor can do to help the trainee to isolate his specific difficulty and to help him re-organize his learning will reduce the duration of the plateau or eliminate it entirely.

(c) Develop class discussion of what the instructor-trainees would suggest in the light of their own experience with plateaus during the learning of specific maneuvers.

- Summarize these suggestions on the blackboard.

c. Reversals. In flight training reversals become evident when the trainee's over-all performance of a maneuver seems to get worse with continued practice.

(1) Point out examples from the curves drawn from the Card-Sorting Experiment.

(2) Reversals often occur when a trainee picks up a bad habit after having reached an acceptable level of performance on a maneuver. The result is that his performance may become progressively worse as he practices the maneuver due to the fact that he also continues to practice the bad habit. For example: In practicing Steep Turns in a light plane, a trainee may acquire the habit of holding top rudder to keep his nose up, and become confused when he finds that in spite of the fact that his nose is on the horizon, he consistently loses altitude because of a pronounced slip.

(3) Reversals may also occur because the instructor has placed too much emphasis on a single unit of a maneuver and neglected the over-all performance. In precision landings, for example, placing too much emphasis on landing in the spot and neglecting to stress the entire pattern of the maneuver may cause some errors to become worse or habitual (e.g., gliding too fast or stretching the glide resulting in mushing) even though the spot may be hit.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan III (Third Hour)

If there has been an extended lapse of time between the second and third hours of this lesson, present a brief summary of the previous two hours.

IV. PRESENTATION AND DEMONSTRATION (Continued)

D. State that a number of other factors which affect the rate at which trainees learn are to be discussed. Present the following points for discussion:

1. The dangers of trying to teach too much too fast.

a. Mention the fact that some beginning instructors try to teach the whole course in the first hour and often feel that the trainee is "slow" or not bright when he fails to catch on.

b. State that phonograph recordings of flight instruction have revealed a common tendency to give further instructions before the trainee has had time to digest the instructions previously given.

(1) Play Phonograph Record 3, Selection A, illustrating this tendency.

(2) As an example of too much instruction cite the remark of the C.P.T. student who said that his instructor talked so much during landings that he got confused, let go of the stick, and let God land the plane. Said the C.P.T. student, "For a while God wasn't doing such a good job."

c. Point out the dangers of trying to teach too many maneuvers in one lesson.

d. Point out:

(1) The use of the "Fundamentals," and ground instruction in general, in giving trainees preliminary instruction before the flight lesson so that less has to be covered in the air.

(2) The use of the "Patter" in defining the essentials of air instruction and the terms in which it can best be given.

2. Transfer of learning and development of habit sequences.

a. Point out that habits learned in one situation may <u>help</u> or <u>hinder</u> learning in other situations, and that such in-

stances are termed "positive" and "negative" transfer.

b. Point out briefly examples of transfer found in the Card-Sorting Experiment. Draw a sample curve on the board.

(1) Positive transfer: As a result of habits learned while sorting cards in Arrangement A, performance on the first trials on Arrangement B was superior to the first trials on Arrangement A. (Refer to learning curves drawn on board.)

(2) Negative transfer: Interspersing trials on Arrangement B temporarily decreased performance on Arrangement A when it was resumed. (Refer to learning curves drawn on board.)

c. Present examples of positive and negative transfer found in learning to fly. The following examples might be used:

(1) Positive transfer: Habits learned in practicing stalls make learning to land easier, since landing is a stall maneuver.

(2) Negative transfer: Habits of coordination learned in making normal turns interfere with coordination of controls during inverted flight. Habit of raising low wing by use of aileron interferes with proper execution of stall maneuver.

d. Point out that many experiments in other fields indicate that the learning of a new, complex performance is made easier if elements of the new performance are learned first and then progressively combined until the whole performance is learned. That is, the simplest element is learned first; it is then combined with the learning of the next simplest element; the combination is then combined with the learning of another element; etc. This is called the formation of "habit sequences." Be sure to point out that the elements must not be taught as if they were isolated. The trainee must always be made to see how they will tie in together to form the whole pattern.

e. Point out how the organization of the order of maneuvers in the W.T.S. controlled flight training course takes advantage of this fact:

(1) In the elementary course stalls are practiced before landings are taught, since landing is an approach to a stall close to the ground.

(2) One method of introducing Immelmanns is to follow the order of preparatory maneuvers presented below:

(a) Loops -- which is the easiest element learned.

(b) The combination of the loop with a quarter roll at the vertical position of the downward part of the loop where the air speed is greatest, and the quarter roll most easily executed.

(c) The Cuban Eight, in which a half roll is executed at the beginning of the downward part of the loop (the next easiest position for the half roll), and another loop begun.

(d) The Immelmann, where a half roll is made just before the top of the loop is reached, the most difficult position in the loop for executing a half roll.

f. Point out that when maneuvers are combined to form habit sequences, negative as well as positive transfer may occur. The following points should be covered on the ground prior to the flight.

(1) Point out that emphasis should be laid on the elements which successive maneuvers have in common (positive transfer). For example, eights on pylons and eights around pylons are both done in reference to ground objects and are further similar in that the pilot's attention must be directed outside of the plane. Show how instances of positive transfer are brought out in "Patter" and "Fundamentals." Show how advantage can be taken of this positive transfer if "Patter" and "Fundamentals" are used. (See Elementary "Patter," pp. 17, 77, and "Fundamentals," pp. 15, 58.)

(2) Point out that emphasis should also be laid on the habits learned in one maneuver which will interfere with the performance of the succeeding maneuver in the habit sequence (negative transfer). For example, the correction for drift in eights around pylons is entirely different from the correction in eights on pylons. Show how this case of negative transfer could be offset by using the "Patter" and "Fundamentals." (See Elementary "Patter," pp. 64-65 and "Fundamentals," p. 49.)

g. Emphasize that the formation of habit sequences can be used in the instruction of students who are having difficulty with certain maneuvers.

(1) Steps to be taken:

(a) The instructor should diagnose the element of the maneuver with which the trainee is having difficulty.

(b) The trainee should be directed to practice this element until he is proficient. It is

extremely important that the instructor explain the relation of the element being practiced to the total maneuver.

(2) Examples: Trainee who is having difficulty rolling at the top of the loop in an Immelmann.

(a) Practice on half rolls from straight and level flight should be given until he is proficient.

(b) Practice on Cuban Eights should then be given.

(c) The Immelmann should again be introduced and practiced, the half roll now occurring at the part of the maneuver where it is most difficult to execute.

h. Ask the class for examples of how habit sequences can be built up in teaching other maneuvers, e.g.,

(1) Stalls in preparation for Spins.

(2) Proceeding from Climbing Turns to Chandelles to Lazy Eights.

3. Training aids.

a. Point out that it has been demonstrated that when a task is explained with a variety of aids (charts, verbal description, models, etc.), learning is faster and more efficient.

b. State that various training aids will be discussed in regard to specific maneuvers in other sections of the course, but that the use of general types of training aids will be discussed at this time.

c. Demonstrate the use of:

(1) Charts, in showing aerodynamic principles, and in making clear the air or ground paths of the plane during specific maneuvers.

(2) Model Plane, with movable controls, in demonstrating plane attitude and control movements. Point out that this is particularly valuable in demonstrating control movements in acrobatic maneuvers.

(3) Photographic records. Point out the value of these when they are available, and demonstrate their use.

d. Develop class discussion on the use of these training aids in instructing in specific maneuvers, and in dealing with specific problems in flight instruction, for example:

(1) A trainee who "fell out" of the top of his loops.

(2) A trainee who drifted away from his pylons in "eights on pylons."

e. Refer to the dangers of using training aids incorrectly.

(1) Memory aids. Many tricks which are supposed to be aids to memory actually cause confusion. ("In 1493 Columbus sailed the deep blue sea.")

(2) Models. Trainee may get an incorrect idea of the performance of a maneuver since controls on the model cannot be coordinated as they are in the actual flight.

V. EVALUATION AND REVIEW

A. Briefly review the characteristics of learning curves.

B. Discuss how a knowledge of positive and negative transfer and habit sequences can be used in this presentation of various maneuvers.

C. Evaluate the use of training aids.

ADAPTING TRAINING TO INDIVIDUAL TRAINEES

Unit Lesson Plan IV (First Hour)

I. AIMS OF THE LESSON

A. To demonstrate individual differences in ability to learn a new task.

B. To discuss the adaptation of instruction methods to the specific problems of the individual trainee.

II. MATERIALS

☐ Data from Card-Sorting Experiment of Lesson III.

Reference materials (in the notebook):

☐ "Job Instruction, A Manual for Shop Supervisors and Instructors."

III. PREPARATION

A. Review the Lesson Plan, and write down illustrations for each of the points to be discussed.

B. Prepare a table of the results of the Card-Sorting Experiment (Lesson III) as required in Section IV-B of this lesson.

IV. PRESENTATION AND DEMONSTRATION:

A. Point out that in previous lessons the characteristics of learning in general have been discussed. In actual flight instruction one trainee at a time is taught, and provision must be made for differences in the way individual trainees learn. The results from the Card-Sorting Experiment will bring out certain types of individual differences which can be expected in most learning situations.

B. Individual Differences as Exhibited in Card-Sorting Experiment.

1. Put on the blackboard the following table of scores of the class for the first and 15th trials, respectively, of the Card-Sorting Experiment (obtained during Lesson III).

	1st Trial Range of Scores	15th Trial Range of Scores
Best 25% of the class	_____	_____
2nd Best 25%	_____	_____
3rd Best 25%	_____	_____
Poorest 25%	_____	_____

2. Analyze the above table so as to bring out the following points:

a. On the first trial there was considerable difference within

the group in terms of speed of sorting. That is, when best score on the first trial was compared with the poorest score, the range of the group was relatively large.

b. When the best and worst scores on the 15th trial were compared, while there were still individual differences in the group, the range was considerably smaller.

c. Point out that a similar situation undoubtedly holds in flight training, i.e., trainees in general differ less in ability at the end of the course than at the beginning.

3. Ask the class how many were in the same quarter (25% of the group as indicated in the above table) in both 1st and 15th trial. Bring out the point that individuals differ in rate of improvement.

4. Ask a number of the persons who had low scores on the first trial, and a number who had high scores, to report how much their scores had improved.

a. Point out that the individuals having low scores at first often show more improvement than individuals having high scores on the first trial.

b. Show the application of this characteristic to flight training, e.g., some trainees who do poorly at first might rank among the highest when the course is ended.

C. Point out that no two trainees will be exactly alike.

1. While selection tests demand that trainees meet certain standards, there is still a wide range of ability among the men who are better than the minimum standards.

2. Each trainee represents a particular combination of traits, abilities, and physical characteristics which makes him different from every other trainee.

D. Discuss differences in the following general areas, pointing out that they will affect the type of instruction a particular trainee should have.

1. Basic physical characteristics.

a. While all trainees are required to pass a rigid physical examination, there still remain wide ranges of physical differences in height, weight, susceptibility to changes in altitude, and even such things as size of feet, which call for particular consideration on the part of the instructor.

b. The individual's special pattern of physical characteristics must be considered in assigning reference points; instructing before solo; adjusting equipment (goggles, helmet, etc.).

2. "Intelligence."

   a. Point out that even though trainees have all passed the selection tests, there are still wide differences in intelligence.

   b. Stress the fact that the typical "intelligence" test is not a perfect measure of all the characteristics which will affect learning.

      (1) So-called "intelligence" involves many factors, such as judgment, attention to details, etc.

      (2) Learning may be affected by many factors not closely associated with intelligence, e.g., timidity, fear, minor ailments, interest, etc.

   c. Stress the danger of blaming failures on the stupidity of the trainee. A man who has passed the screening tests is pretty certain to be intelligent enough to be successful in aviation. It is up to the instructor to find the specific causes of the trainee's difficulty. (Problems of slow learning will be discussed more fully in later sections.)

3. Background.

   a. Point out that differences in education, experience, and interests are not greatly restricted by the screening tests. They will greatly affect the type of instruction given a trainee. An engineering student, for instance, probably would not need as complete an explanation of certain aero-dynamic principles as would a trainee whose education had been in liberal arts.

   b. Indicate that background includes not only education and occupational experience, but also such things as hobbies, athletic activities, etc.

   c. Bring up the point that trainees whose previous occupations have been in fields unrelated to aviation may be somewhat slow in "catching on" in the early part of the course. The instruction of such trainees should include particular emphasis on fundamentals.

4. Appearance and personality.

   a. Indicate that differences in personality will affect instruction in many ways to be pointed out later in this lesson.

   b. Suggest that the instructor must recognize that the appearance or personality of some trainees will rub him the wrong way. He should be careful not to let personal prejudices influence the quality of his instruction or the accuracy of his grading and evaluation.

5. Refer again to the importance of the particular combination of traits, abilities, and physical characteristics in the individual. Superior aptitude for flight training is not one single ability, but is due to favorable combinations of previous experience and education with certain physical and mental characteristics.

E. Characteristics of trainees encountered during flight instruction which may be neglected or not understood by the instructor.

1. The following characteristics of trainees should be presented for class discussion:

a. Slow starting.

b. Unusually fast learning.

c. Overconfidence.

d. Underconfidence.

e. Overenthusiasm.

f. Others as given by the class.

F. Select one of the characteristics suggested by the class.

1. Discuss it from the following aspects:

a. Possible causes.

b. Cues for recognizing the characteristic.

c. Possible methods of handling.

2. Example: slow starting.

a. Possible causes.

(1) Missed important basic point in first few lessons.

(2) Confused because of new environment -- due probably to lack of previous experiences in situations comparable to flying. (Point out the state of confusion which most of the class experienced on the first few trials of the Card-Sorting Experiment.)

(3) Poor coordination, due perhaps to lack of experience with tasks requiring coordination.

(4) Bored, or tense, due to poor instructional technique.

b. Cues for recognizing the characteristic.

(1) Indicate that the instructor with a moderate amount of experience has no difficulty in recognizing a trainee who is unusually slow in starting. The beginning instructor may expect too much of a trainee, and must be on guard against assuming that most of his trainees are "slow."

c. Methods for handling.

(1) Giving particular emphasis to clear explanations of basic points, particularly during ground instruction.

(2) Introduction of new maneuvers more slowly during early part of the course.

(3) Use of praise, even for slight progress, whenever possible, to build up trainee's confidence.

(4) "Taking the pressure off," i.e., assuring the trainee that he should not become unduly worried about getting a slow start. Point out that if such a trainee must be washed out he will be washed out, but that continual urging him to do better will only result in his feeling less confident, and "trying too hard."

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan IV (Second Hour)

If there has been an extended lapse of time between the first and second hours of this lesson, present a brief summary of the topics discussed during the first hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

G. Discuss several of the remaining characteristics listed in Section IV, E, of the outline of the first hour of this lesson, by having members of the class present their analysis of each characteristic in terms of possible causes, cues for recognizing, and possible methods of handling.

1. On the basis of the above discussion, emphasize the following points:

a. Each characteristic may have <u>many</u> causes, e.g., a fast learner may have had previous flight training, he may have had experience in other jobs requiring motor coordination, he may have had a particular interest in aviation, or have studied aerodynamics, etc.

b. Each individual must be analyzed separately and the <u>specific</u> cause or causes of his difficulty identified.

c. There is no "born flyer" type. Flying comes <u>more easily</u> to certain individuals for many different reasons: particular combinations of abilities, background, experiences, motivation, etc.

H. Discuss the tendency to "type" individuals.

1. There is a tendency to over-simplify analysis of individuals by classifying them into "types" according to:

a. One outstanding characteristic: assuming that an individual who <u>moves</u> slowly is going to <u>think</u> slowly.

b. Resemblance, in terms of behavior or personality, to an acquaintance or a previous trainee: "He's just another Smith."

c. Performance on one part of the total job: letting a trainee's performance on a "favorite" maneuver or on the last maneuver in the lesson determine the evaluation of his performance as a whole, or letting the trainee's first performance determine how he is handled for the remainder of the course.

2. Such a "typing" is dangerous because:

a. All individuals so "typed" do not possess all the alleged characteristics of the "type."

b. "Typing" is based on the "either-or" principle, i.e., an individual either belongs in the type or does not. Actually, characteristics are distributed in gradations and we should think in terms of "how much" of a characteristic the individual possesses, i.e., how confident, how touchy, how clumsy, etc.

c. The instructor who "types" his trainees may feel that all trainees showing a given characteristic are to be treated in the same way.

(1) Appearances may be misleading.

(a) The trainee who appears boastful and tends to show off may actually be covering up a "feeling of incompetence."

(b) The trainee who says, "Yes, I understand," may not actually understand but only be afraid of appearing stupid if he says he doesn't.

(2) Trainees may change "types" suddenly, e.g., the slow starter may progress normally after "getting the hang of it." "Typing" in the early stages of training is especially dangerous.

3. Refer to Section 7, "Understanding the Individual Learner," in "Job Instruction, a Manual for Shop Instructors," and assign it as outside reading.

I. Treating trainees individually.

1. Point out the necessity of determining, in so far as possible, the specific factors causing a trainee's difficulty.

2. Emphasize that definite steps should be taken to deal with the specific causes of such difficulties.

a. Example: A certain trainee consistently "dragged" his right wing in his approaches and landings, due to the fact that he pulled the stick over to the right as he exerted back pressure. The instructor had him spend ten minutes on the ground, practicing pulling the stick straight back, in such a way that the ailerons would not move at all. (The instructor in this case exerted enough pressure on his control stick to simulate the conditions of actual flight.)

3. Stress the necessity of the instructor's taking notes and keep-

ing a personal record of the progress and specific problems of each of his trainees ("Personal Log Book"), and working into the daily flight-instruction plans of each trainee provisions for his particular requirements.

4. Bring out that these records should:

   a. Be practical--small cards or forms which take little time, and which can be used on the field.

   b. Provide concise information on general progress, outstanding characteristics, specific problems, etc., of each trainee.

5. Assign as outside work the preparation of such forms. Indicate that the construction and uses of a "Personal Log Book" will be taken up for discussion in subsequent lessons.

V. REVIEW AND CONCLUSION

A. Summarize the two sessions on "Adapting Training to Individual Trainees," reviewing the main ideas presented:

   1. Each trainee represents a particular combination of the characteristics important for learning to fly. Trainees should not be "typed."

   2. Each trainee's characteristics should be analyzed carefully and provision made for his particular problems.

   3. A systematic record of each trainee's progress will aid in adapting instruction techniques to the individual trainee.

B. Point out that methods for planning each instruction session will be discussed in detail in later lessons.

KEEPING THE TRAINEE INTERESTED

Unit Lesson Plan V (First Hour)

I. AIMS OF THE LESSON

A. To impress upon the instructor-trainee the importance of keeping the trainee interested and highly motivated.

B. To describe some procedures which are helpful in motivating the trainee and in maintaining his interest.

II. MATERIALS

- ☐ Phonograph.
- ☐ Phonograph Record 2, Selection B.
- ☐ Phonograph Record 3, Selection B.

Reference materials (in notebook):

- ☐ "General Principles of Learning."
- ☐ Transcript of Phonograph Record 2, Selection B.
- ☐ Transcript of Phonograph Record 3, Selection B.

III. PREPARATION

A. Read the references on Motivation in Learning in "General Principles of Learning."

B. Make notes of examples from flight training which illustrate the points brought out in the references.

C. Play demonstration records through several times before the lesson so that you are familiar with them.

IV. PRESENTATION AND DEMONSTRATION

A. Introduction.

1. Open the first hour on this topic by pointing out that learning proceeds most effectively when the trainee is working toward a definite goal which can ultimately be reached. This goal in flight instruction is to become an expert pilot.

   a. The flight instructor should constantly keep this goal before the trainee and himself, and define it in terms of specific levels of accomplishment for each flight lesson.

2. Further define "motivation" as it applies to flight instruction.

   a. Motivation in flight instruction can be defined as the development in the trainee of a desire <u>to learn</u> to be an expert pilot.

b. Emphasize the distinction between just "desire to fly" and the "desire to learn to fly well." All trainees have some desire to fly but not all trainees are willing to put forth the effort that it takes to learn to fly well.

B. The importance of the instructor in motivating the student.

1. Point out that the development of the trainee's desire to learn to fly well depends largely on the type of instruction he is given.

a. Some trainees are willing to try harder than others, but the amount of effort exerted by any given trainee will be greater if the instructor takes every opportunity to maintain and heighten his interest.

b. Point out that it is much easier for the instructor to maintain the desire to fly than it is to revive it if poor instruction kills it.

2. Ask for and discuss with the class examples of trainees who while they liked to fly, dreaded their flight lessons because of the way they were handled by their instructors. (For example, the case of the cross-country instructor who never permitted the students to take off or land and who heckled continuously.)

C. State that a number of methods for "keeping the trainee interested" will be discussed in this session and the next.

1. Setting goals for the trainee to shoot at.

a. Reemphasize the point made earlier that the final goal is the development of an expert flyer. If the beginning flyer compares himself to the experts, however, he may easily become discouraged. Progress will be more evident to the trainee if daily goals or levels of performance are set for him. As the trainee reaches one level, the "sights" should be raised, i.e., a higher level of performance should be set for the trainee to shoot at in the lesson immediately following.

(1) Show how the order of introduction of new maneuvers in the flight course is based on this principle. (In general, maneuvers are introduced in order of their difficulty, medium turns preceding steep turns, stalls preceding spins, etc.)

(2) The instructor must consider the progress and ability of the individual trainee in setting up the daily level of accomplishment to be reached.

2. Keeping the trainee informed of his progress.

a. Point out that experiments in industry have indicated that when individuals learning a new task are regularly and accurately informed about the progress they are making, their rate of learning is increased.

b. A survey of trainees' criticisms of instructors revealed that certain instructors did not tell the trainees whether their performance was good or bad, or whether or not they were making any progress. This only confuses the trainee because he is unable to distinguish correct performance from poor performance.

c. Present for class discussion: "How should the trainee be informed of progress and how much should he be told?"

(1) Informing the trainee of his progress does not necessarily involve letting him see the grades given to him in the log book, but it does involve informing him of his good points as well as his errors. Criticism must be followed by accurate instruction in how to correct the errors.

(2) The instructor can often employ a comparison of a trainee's performance with the rest of the group but this method must be judiciously used; one trainee must never be compared with another individual trainee, e.g., if John Jones would only get the tail down on his landing he would be as good as the rest of the class on landings.

d. Summarize the importance of keeping the trainee informed of his progress as a "motivating device." Tie in the points brought up with the use of "directed learning" and practice along the lines of a particular trainee's specific inadequacies.

3. Use of praise and reproof in motivating the trainee.

a. Indifference is the worst way to handle a trainee! Experiments have been performed to compare the learning speeds of groups of individuals who were given: all praise; all reproof; and neither. Results showed that:

(1) Those who were praised learned much the fastest.

(2) The learning of those who were reproved was slower than those who were praised, and slightly faster than those who received neither praise nor reproof.

b. Failure to give either praise or reproof develops a feeling on the part of the trainee that the instructor doesn't care how he progresses. Also the trainee will not be able to distinguish good from poor performance. A combination of praise and reproof is probably the most effective method to employ.

c. Play Phonograph Record 2, Selection B.

d. Present for class discussion the question: "What is the effect on the trainee of the sort of flight instruction indicated in the recording?" Develop the following points:

(1) Continued reproof makes a trainee antagonistic to, rather than receptive to, instructions. Cite the Naval Aviation Cadet whose instructor asked him if he would like two-way communication. "No, Sir," replied the cadet. "Why?" asked the instructor. "Because, Sir, it is courtmartial to swear at an officer."

(2) It would have been much more efficient for the instructor in the recorded flight lesson to have told the trainee calmly what was wrong, and how to correct it.

(3) When a trainee is continually reproved for minor errors he will not appreciate criticism regarding serious errors.

e. Present for class discussion the question: "How should praise and reproof be used in flight instruction?" Bring out the following points:

(1) Praise, to be effective, should be merited, and should always be accompanied by a statement regarding <u>what</u> the trainee did well.

(2) Trainees occasionally need a good "dressing down" but in order for such reproof to be effective it must always:

(a) Be sharp, to the point, and warranted.

(b) Come as a contrast to the usual relationship between instructor and trainee.

(c) Be given at the time the error was committed.

(d) Include a calm statement of what the trainee should do to make further "bawling out" unnecessary.

(e) Be the result of a major mistake. Minor errors should merely be talked over and corrected. If a trainee is continually "bawled out" for minor errors, reproof for the major ones will not "sink in."

(3) Praise is, in general, more effective than reproof. A good idea is to praise whenever possible and criticize only when absolutely necessary.

(4) Praise and criticism are generally more effective when used together. If a trainee must be criticized strongly, some other point, even a small one, should be found on which he can be commended.

(5) Point out that reproof should be given in private. When an instructor "bawls out" a trainee before other trainees the instructor "loses face" even more than the trainee, and loses the confidence of the other trainees.

D. Present for class discussion the handling of overconfident and underconfident trainees and show how suggestions offered under "Setting goals for the trainee to shoot at," "Keeping the trainee informed of his progress," and "Use of praise and reproof in motivating the trainee" can be applied in dealing with such cases. Summarize the class discussion in terms of:

1. Handling the overconfident trainee.

a. If a trainee is overconfident the instructor should raise the required levels of performance for each lesson. This will demand that the trainee put forth more effort in order to learn a given maneuver. These levels should never be set so high that the trainee is unable to reach them.

b. At the same time he should be accurately checked and informed of his progress. While the trainee may be satisfied with his over-all performance in a maneuver, an analysis of the details of the maneuver may reveal several points in which he is weak. The trainee should be very carefully checked on his understanding of the principles underlying the maneuvers. Quite often the overconfident trainee has only a superficial knowledge of these principles.

c. The instructor should not cease praising such a trainee for his good performance if he has adequately increased levels of proficiency during a given lesson. Too much criticism or reproof is just as harmful to this trainee as to anybody else. The instructor should make every effort to encourage this trainee to raise his personal standards of proficiency.

d. The instructor should be very careful not to reduce the amount or quality of instruction just because the trainee "seems" to be doing satisfactorily by himself. There is a tendency on the part of some instructors to ease up in their training of overconfident trainees.

2. Handling the underconfident trainee:

a. If the trainee is underconfident the instructor should set successive subgoals which the trainee is reasonably certain to reach, making it evident to him that he is progressing. Then, as confidence is gained, the "sights should be raised," or higher levels of performance set for succeeding lessons, until the trainee is progressing normally. Remember that the trainee will not be fully confident until he realizes that he is progressing as rapidly as the rest of his class. Although he will take a little more time than the other trainees, he must ultimately reach the same level of proficiency.

b. The instructor should be very careful to inform this trainee of his progress. More emphasis must be placed on those aspects of his performance which he successfully completes. Specific care must be taken to point out or to demonstrate how errors are to be corrected.

c. Criticism of this trainee for his errors must be less harsh and always accompanied by praise for his correct performances. The underconfident trainee is very easily discouraged by too much or too severe criticism. The instructor can effectively use some of this praise in public.

d. The instructor must be careful not to lower the ultimate standards of proficiency for this trainee. He must also be careful not to spend a disproportionate amount of time with the underconfident trainee.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan V (Second Hour)

If there has been an extended lapse of time between the first and second hours of this lesson, present a brief summary of the topics discussed during the last hour and say that some other methods will be taken up this hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

E. Other methods of motivating the trainee and maintaining his interest.

1. Developing a feeling of "group responsibility" in the trainee.

a. Emphasize the importance of the part played by the instructor in developing a feeling of "group responsibility" in his trainees.

(1) The trainee must be made to feel that he and the instructor are working as a team.

(2) He must also be made to feel that he is responsible for the welfare of the group not only in training but in later combat operation.

b. Such techniques as the following may be useful:

(1) An attempt could be made to get the group of trainees together in the morning, before the flight lessons begin, to conduct a thorough line inspection of the plane. During this inspection the instructor should emphasize the responsibility of each trainee for the safety of the entire group.

(2) The instructor should emphasize the necessity of the trainee's reporting any misuse of the plane or defects in rigging which are evident during a particular lesson.

(3) He should encourage group participation and responsibility in preparation and discussion of ground school subjects.

(4) On rainy days the instructor could hold "hangar sessions" with his group of trainees. These should be "directed" discussions and not just bull sessions.

(5) The instructor should have the trainees present, if possible, during some of the 20-hour checks or 100-hour checks, and during any repairs and alterations which are made on the plane.

2. The use of "pep-talks" in heightening trainee interest.

a. By means of carefully prepared "pep-talks" the instructor can heighten the trainee's sense of responsibility and his desire to become as skillful a pilot as possible.

(1) Point out that much of the trainee's later flight duties will involve formation flying. Show, for example, how practice and perfection of precision turns is important in formation flying and what it would mean if one member of the formation was not precise in his turns.

(2) Point out that in combat flying the trainee may endanger himself or the group he is flying with by some error in his flying resulting from failure to apply himself during training.

(a) Explain that the best life insurance for combat duty for both the individual and the group is that every man become as proficient as possible.

3. Instruction from the trainee's viewpoint.

a. One of the best ways to keep a trainee interested (to motivate him) is to orient the instruction from his viewpoint.

(1) Trainees often feel that instructors are trying to wash them out, rather than to help them over the rough spots of their flight training.

(2) The trainee must be made to feel that the instructor has a personal interest in him and is doing everything he can to make him an expert pilot.

b. Mention the results of a study at the Hawthorne plant of Western Electric, in which the effects of certain types of working conditions on employees were being investigated.

(1) The results indicated that with every change in working conditions, the experimental groups' production became higher.

(2) The conclusion was that the very fact that the management was interested in the employees increased their output.

(3) Point out the implications of these findings for handling the trainee.

c. Point out the following common examples of failure to appreciate the trainee's problems on the part of the instructor:

(1) Failure to realize the instructor is not, literally, "in the trainee's shoes," or in his seat in the plane.

(a) When the instructor is pointing out relationships between reference points on the plane and the horizon or the ground, he must realize that these points do not appear the same to him as they do to the trainee. He should make certain that the trainee sees (or is able to see) the same reference points that he (the instructor) sees, or he should direct the trainee while he picks his own reference points.

- For example, in demonstrating "eights on pylons" the instructor should execute the maneuver properly and let the trainee pick reference points which should be lined up with the pylon. If the trainee picks impractical points, the instructor should correct him immediately.

- Research has shown that some elementary trainees have trouble learning to fly straight and level because they climb or glide when they line up with the horizon the points on the plane recommended by the instructor. The instructor must allow for the difference in height between himself and the trainee and the difference in their relative positions in the plane.

- Mention the case revealed by the recorded instruction in which the instructor reproved a trainee for not following a road as directed. It developed that the trainee was following a road, but a different one from the road suggested by the instructor. The trainee could not see the one pointed out by the instructor unless he leaned out of the window of the cabin.

(2) Another type of failure common to instructors is their failure to appreciate and understand the trainee's learning problems.

(a) Play Phonograph Record 3, Selection B. (In this recorded flight lesson on 180° Approaches, the instructor repeats over and over the following rule to determine where to cut the throttle: "Just watch your height and distance from the field.")

- Ask for criticisms from the class of this recorded instruction. Point out that the instructor failed to elaborate and to explain that the closer the plane is to the field, or the greater the altitude, the sooner the throttle is to be cut.

- Mention the fact that after the trainee came down, he was asked if he understood what the instructor was driving at. "Hell, no," said the trainee.

(b) Ask whether a mistake such as that illustrated above is more likely to be made by a man who has learned to fly easily or by one who had trouble in learning to fly.

- Point out that there are some who believe that a man who, in learning to fly, has experienced most of the problems developed by his trainees may be better equipped to understand and help in solving such problems than a man who has learned to fly quickly and easily. Since instructors must be topnotch pilots they are usually the men to whom flying came easily. Instruction may, therefore, call for <u>increased</u> effort on their part if they are to understand the difficulties and help those trainees to whom flying skills do not come so easily.

- The instructor must develop special techniques for explaining points which are now, or have always been, self-evident to him. ("Patter" and the "Fundamentals" are of aid here.)

- The instructor must learn to recognize and to treat the trainee's difficulties as learning problems rather than as signs of stupidity.

V. REVIEW AND EVALUATION

A. Point out that motivation can be summarized under four points:

1. The trainee must "want" something -- to learn how to fly expertly.

2. The trainee must be told what to do, and how to do it, in order to satisfy his want.

3. He must do it.

4. He must get something for it -- praise, feeling of accomplishment; some sort of reward.

B. From class discussion, bring out how the topics discussed in this lesson fit under these four points.

ASSIGN C.A.A. Bulletin "How to Prevent Air Sickness" as outside reading for next lesson.

The following source, in addition to those listed under "Materials," was used in the preparation of Unit Lesson Plan V:

The investigation of flight instruction conducted by E. L. Kelly at Purdue University. (This is the study from which "Sample Student Comments," Unit Lesson Plan I, were derived.)

KEEPING THE TRAINEE FIT

Unit Lesson Plan VI (First Hour)

I. AIMS OF LESSON

A. To point out the implications of physical condition and emotional stability for flight training.

B. To discuss various aspects of physical and emotional fitness.

C. To suggest methods for handling problems arising in connection with physical and emotional fitness.

II. MATERIALS

☐ "How to Prevent Air Sickness."
☐ "Fit to Fly" by Malcolm C. Grow and Harry G. Armstrong. New York: Appleton-Century, 1941, pp. 327-331.
☐ "Flight Instructor's Manual," C.A.B. #5.
First edition: June 1939, Chpt. III and pp. 119-121.
☐ or Third edition: September 1941, Chpt. V and pp. 104-106.

Reference materials (in notebook):

☐ "Standard Check Flight Procedures."
☐ "Introspective Reports on Learning to Pilot an Aeronca Chief Plane."

III. PREPARATION

A. Read this outline carefully, since most of the material to be discussed will be covered in it.

B. Read the references listed above.

IV. PRESENTATION AND DEMONSTRATION

A. The instructor's responsibility for trainee fitness.

1. Open the class by stating that the next two periods will be given over to a discussion of the problem of keeping the trainee fit. Point out that although at first thought this might seem to be the job of the doctor or flight surgeon, it is also the instructor's concern, since learning is greatly affected by physical condition.

2. Point out that it is important for the trainee to be in good physical and emotional condition.

a. A trainee who is "under the weather" will not learn as rapidly as a healthy one.

b. Trainees often will not go to a doctor of their own accord for fear it will affect their status in the course.

c. Some symptoms can be recognized by the instructor better than they can by the trainee.

d. Faulty training may impair the fitness of trainees by:

(1) Increasing fatigue.

(2) Aggravating air sickness.

(3) Implanting fears.

(4) Making the trainee discouraged, nervous, uncertain, etc.

e. Certain problems of physical and emotional fitness can be dealt with effectively by the instructor.

B. Colds and other common ailments.

1. Present for class discussion the question: "How would you handle a trainee who reported for a flight lesson with a heavy cold?" Bring out that:

a. He should be asked if he has seen the doctor, to determine whether he is in shape to fly.

(1) If a trainee has been sick in bed for three days or more, C.A.A. regulations require that he have a physical examination before his ticket is valid.

(2) If the trainee has ear trouble, he should not fly unless he has the doctor's OK.

b. If the trainee is allowed to fly (whether or not he has seen the doctor), colds may result in:

(1) Pain in ears and head due to altitude changes.

(a) If the trainee complains of ear trouble he should not be brought down <u>suddenly</u>. A rapid change in air pressure might rupture his ear drums.

(2) Reduction of visual efficiency.

(3) Greater susceptibility to air sickness.

(4) Greater susceptibility to fatigue.

c. In view of these facts the instructor should:

(1) Fly the trainee dual, if at all possible.

(2) Demonstrate, or have the trainee practice, maneuvers which do not involve violent acrobatics or great altitude changes. If necessary, merely devote the lesson to a review of fundamentals.

(3) Cut the lesson time somewhat shorter than usual.

2. Point out that many of the points brought out in the discussion of the common cold apply to other mild ailments, e.g., stomach trouble from improper eating.

C. Effect of drugs on flying ability.

1. Certain medicinal drugs, such as any of the sulpha drugs, or atabrine or quinine, have physical and often mental effects which make a pilot unfit for flying for a period of time after their administration.

2. Hangover from too much alcohol often renders a pilot unsafe.

3. Point out that the instructor should be certain that the effects of such drugs have worn off before flying a trainee. If necessary, a doctor should be consulted.

D. Air Sickness.

1. Get the opinions of the class regarding the C.A.A. Bulletin "How to Prevent Air Sickness."

2. From the discussion, find out the points which the class feels to be most important, and write them on the blackboard in summary form.

3. Emphasize the following points:

a. Tendency to get air sick, which is one kind of motion sickness, is not an indication of cowardice or weakness on the part of the trainee. Cite cases of motion sickness occurring in "old hands" in aviation.

b. Prevention is the best cure.

(1) Introduction to violent maneuvers should be brief. If the trainee shows signs of sickness (paleness, excessive swallowing, or yawning) the troublesome maneuvers should be discontinued or the trainee should be brought down.

(2) The instructor should avoid talking the trainee into being air sick -- if he asks how the trainee is feel-

ing, he should be casual, and not give the impression he is expecting the trainee to be air sick.

(3) Hint to instructor: Trainees susceptible to air sickness should have a minimum of flying as "passenger."

(a) During demonstrations the trainee should be given something to do -- something to take his mind off his symptoms.

(b) The trainee should be told beforehand what is coming next, so that he can adjust to it.

c. The trainee who becomes air sick once, need not become a chronic case.

(1) The instructor should be understanding and sympathetic and above all optimistic -- air sickness is rarely chronic. He should give the trainee the impression that it is something that can happen to anybody.

(2) The instructor should try to recall what maneuvers or particular motions made the trainee air sick. Then in the next few lessons he should introduce these maneuvers briefly at first, then gradually prolong them. When the trainee gets used to performing the maneuvers without being air sick, he is practically cured.

(3) Air sickness is often caused by the fact that the trainee has eaten improperly or too much (a heavy meal or a bottle of coke) just before the flight. The instructor should be on the lookout for such points, and caution the trainee to change his eating habits, if necessary.

(4) Point out that tight-fitting or uncomfortable equipment (goggles, helmets, etc.) may aggravate certain physical factors and precipitate air sickness in the trainee.

d. The instructor should watch out for cases of "incipient" air sickness, i.e., cases where the trainee feels uncomfortable without knowing exactly what is wrong with him. Emphasize that "incipient" air sickness will, in the long run, have as bad effects on flying and on learning as has complete air sickness and that the prevention and treatment are essentially the same in both cases. (Refer to p. 2 in "How to Prevent Air Sickness.")

e. Instructors should assume responsibility for air sickness in their trainees. When instructors at the Rochester, N.Y. airport were required to clean up the ship, the washouts from air sickness were considerably reduced.

E. Fatigue.

1. Emphasize that everything the instructor can do to minimize fatigue on the part of the trainee makes the instruction job easier.

2. Point out:

   a. Instructions don't "soak in" well if the trainee is fatigued.

   b. Fatigue reduces motivation. The trainee doesn't "give a damn."

   c. Fatigue affects coordination, and may reduce efficiency below the danger point.

3. The importance of recognizing fatigue in a trainee.

   a. Indicate that the trainee himself is not always a good judge of his state of fatigue. One characteristic of extreme fatigue is a tendency to continue with the fatiguing task.

   b. A trainee may insist that he never felt better at the very moment when his efficiency is very much lowered. He may actually be endangering himself and others if allowed to continue.

   c. The effects of fatigue may persist over a long period of time.

4. Characteristics of the overtired trainee.

   a. The trainee's performance is likely to appear erratic when he is tired. He will be in a slump, and then by exerting extra effort, show a short period of acceptable performance. This will probably be followed by another slump, etc.

   b. He may find it harder to shift his attention from one item to another.

   c. New details may escape his attention altogether.

5. Present for discussion the question: "What are the causes of trainee fatigue, and what can the instructor do about them?" Bring out the following as causes of excessive fatigue:

   a. "Tension" in the trainee. (State this will be discussed fully in the next period.)

   b. Excessive length of lesson.

   c. Too much drilling on one maneuver.

d. Equipment difficulties: poor adjustments of seat and controls, badly fitting goggles, chute, etc.

e. Unhealthy conditions in the plane. It is the instructor's responsibility to make sure the training plane has no gasoline vapor leaks, fire-extinguisher leaks, carbon-monoxide leaks.

f. Weather conditions: rough air, or excessive cold or heat.

g. Indicate that studies have been made to determine whether the noise and vibration of the plane lower efficiency of performance. In general, there seems to be little measurable effect on performance even when noise and vibration are continued over a period of five hours. However, it is still possible that extra effort is exerted to maintain good performance under such conditions.

6. Point out that the instructor can deal with the problem of fatigue by:

a. Seeing that the plane is properly rigged, seat and controls properly adjusted.

b. Trying to determine cause of fatigue and correcting it. For example, a trainee may be tired from concentrated practice on one maneuver. He should be given a "break" by going on to some other maneuver temporarily.

c. Adjusting the length of lesson to conditions. If excessively rough air is encountered, or if it is extremely hot or cold, the lesson should be cut short.

d. Checking up on the trainee's "extra-curricular" activities.

e. Being especially careful on Mondays, or after leaves.

7. Emphasize that trying to teach a tired trainee is a waste of time for both the instructor and the trainee.

8. Point out that in discussing physical and emotional fitness, "tension" deserves special consideration, and that this topic will be taken up in the next period.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VI (Second Hour)

If there has been an extended lapse of time between the first and second hours present a brief summary of the topics discussed during the past hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

F. Meaning of "tension."

1. Open the class discussion by asking members to define what they mean by "tension." The class probably will not give adequate definitions. They will give descriptions. Jot down on the blackboard a word or term for each description.

2. Cite the results of the interview study conducted at the University of Maryland, in which it was found that instructors used the word "tension" to refer to the following conditions:

   a. Increased muscle tonicity, e.g., resistance to passive movement of controls.

   b. Poor coordination in use of controls, e.g., jerky, abrupt movements.

   c. Signs of fear, e.g., excessive perspiration, leaning from bank.

   d. Narrow range of attention, e.g., fixed gaze, failure to absorb instruction.

   e. Great effort, e.g., "trying too hard to learn."

3. Point out that these results show the importance of stating just what sort of tension is being talked about. State that the term is perhaps most frequently used to refer to "muscular" tension which occurs when opposing sets of muscles are made to contract simultaneously.

4. Indicate that instructors also do not agree on whether a mild degree of "muscular" tension is good or bad.

   a. Some feel that it is good as a sign of alertness.

   b. Most feel that it is bad when it leads to fatigue or rough use of controls.

   c. Point out that the important point would seem to be that if the "tension" does not interfere with the trainee's performance it is all right.

5. Discuss ways in which trainees exhibit "muscular" tension.

   a. "Standing" on the rudder pedals.

   b. Creeping on the throttle.

   c. Squeezing the stick.

   d. Not riding with the plane.

6. Summary of other results of the Maryland Tension Project.

   a. Studies of grip-pressure and rudder-pressure showed:

      (1) Wide variations in the "muscular" tension of trainees.

      (2) Some trainees showed tension chiefly in their grip, others in their rudder pressure.

      (3) There seemed to be little relation between measures of "muscular" tension and estimated skill of pilots.

      (4) The trainees of some instructors showed greater tension than the trainees of other instructors. (Stress the importance of this point for instructor-trainees.)

7. Discuss causes of tension. Point out that tension, including both "muscular" tension and tension as otherwise defined, may result from a number of different conditions such as:

   a. Fear (of failure, of a bawling out, of losing control, etc.).

   b. Lack of proper preparation by previous ground instruction or air demonstration.

   c. Sudden movements or commands from the instructor.

   d. Trying too hard (trying to do too much too fast).

   e. Suggestion (movies, stories, etc.).

   f. Physical ailments, hangover, etc.

   g. Poor inter-communication. (Discuss relative merits of gosport and new type electrical inter-communication.)

8. Discuss means of avoiding or overcoming excessive tension. (Indicate that the treatment will vary with the type of tension.)

   a. Good preparation and orderly presentation and demonstration.

b. Proper speech habits on the part of the instructor.

(1) The instructor should realize that any intercommunication system has deficiencies, and should make every effort to speak clearly and distinctly.

(a) Point out the difficulties in understanding the instructions in many of the phonograph recordings.

(2) The instructor should never talk any more rapidly or excitedly during emergencies (real or simulated), e.g., forced landings, than under normal circumstances.

(a) Emphasize that this leads to distrust of the instructor on the part of the trainee or that it will over-excite the trainee or make him afraid.

c. The instructor should make flying seem a common everyday occurrence.

d. The instructor should be casual without giving the impression of carelessness.

e. The instructor should not take over suddenly or too frequently. When he does take over, he should seem to be assisting.

f. The instructor should not make the trainee mad, disgusted, or frightened.

g. The instructor should get the trainee to look around, talk once in a while about things away from the airfield, even sing. Be human.

H. Emotional reactions.

1. Point out that the instructor is in a very good position to notice signs of emotional imbalance even before the trainee realizes what is the matter.

2. Discuss the general problem of emotional reactions as it is usually encountered in flight training.

a. Point out that very few trainees go completely "crazy" during the course of their training and that this extreme group need not concern the instructor.

b. Explain that the real problems are presented by those trainees who react inadequately to difficulties encountered in their flight training, i.e., show minor maladjustments.

(1) Point out that such trainees react to their difficulties by an excessive display of emotion (by "blowing up" or "sulking"), rather than by making a direct and straightforward effort to overcome them. Remind the group that such extreme reactions are rarely incurable; that, on the contrary, they can be both prevented and overcome by the good instructor.

(2) Of particular concern to the instructor is the trainee whose emotional reactions to difficulties noticeably affect his flight training or will affect his safety in subsequent flight experience.

3. Some causes of emotional disturbance or maladjustment on the part of the trainee.

a. Broadly speaking, the trainee who reacts emotionally to a difficulty encountered in flight training does so because he feels unprepared to cope with the situation.

(1) Point out that this may be because he cannot specifically outline the difficulty, because he has not been given adequate training; or because he does not actually know how to handle the problem even though he recognizes it. He may always have had "someone else" to solve his problems for him; he may be "clashing" with the instructor; he may actually be afraid; he may be in aviation "against his will"; he may be having trouble at home or with ground school; etc., etc., etc.

(a) Any or all of these reasons may be involved when one considers a given trainee. Of course, the list can be greatly extended.

(b) The major point here is that the instructor must be on the lookout for such underlying causal agents if he is effectively to handle and reorient the unadjusted trainee.

4. Ways to recognize emotional disturbance or maladjustment in the trainee.

a. It must be stressed that the instructor will be making a grave mistake if he takes all symptoms at "face value"; the symptom may be only an indication of some more basic underlying difficulty.

b. Discuss the following symptoms or "danger signals" of emotional strain, relating them to the above causes (see "Fit to Fly," pp. 327-331):

(1) Restlessness or irritability.

(2) Excessive complaints of overwork.

(3) Undue apprehension or over-cautiousness: The trainee may lack self-confidence; may be relying too much on the instructor; may be afraid; may have no confidence in the instructor; may not understand the maneuver or the basic principles; etc.

(4) "Cockiness" or undue recklessness: This trainee may actually be afraid and unsure of himself and of the instructor, and is covering it up with a "devil may care" attitude; may think he understands but actually doesn't; etc.

(5) Surliness and pouting: The trouble here is generally with personality "clashes" between the instructor and the trainee. However, as in the other symptoms the trainee may just be discouraged, uncertain of himself, and afraid; etc.

(6) Complaints of insomnia or light and fitful sleep: Here again the trainee may be uncertain of exactly how to meet his problems in flying or in ground school; be afraid of washing out; etc.

(7) Chronic complaints of physical ailments, e.g., aviator's stomach; headaches; indigestion; belching; diarrhea; constipation; etc. This trainee may just be complaining of these disorders to avoid an unpleasant maneuver; because he is afraid; because he doesn't want to fly; doesn't trust himself or the instructor; etc.

5. How the instructor can help maintain the trainee's emotional balance and avoid emotional maladjustment.

a. The instructor should never belittle the trainee's emotional reactions nor get into an "argument" about them. They should be treated as any of the trainee's problems are treated: objectively, openly, and constructively.

b. Point out that the best way to prevent emotional reactions is carefully to prepare each student to meet the difficulties which he encounters. Careful and accurate preparation of lessons will do much to insure that the trainee will gain self-confidence, and will dispel much of his fear of flying.

c. Emphasize that the instructor should make every effort to avoid personality clashes between himself and the trainee. Giving too much criticism and not enough praise often generates not only a dislike for the instructor but also feelings of incompetence on the part of the trainee.

d. Point out the value of giving the trainee a chance to talk over all or any of his personal problems with the instructor.

Once these problems are talked out they will not seem so insurmountable to the trainee.

e. Point out that in cases of serious emotional involvement, the instructor is not the man to handle the job and that real damage might be done if the trainee is forced to continue to fly. The trainee who is having serious trouble should be sent to a doctor without giving him the impression that anything is seriously wrong with him.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VI (Third Hour)

If there has been an extended lapse of time between the second and third hours present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

H. Emotional reactions (Continued).

6. Ask the class where emotional problems are most likely to arise during flight training. Develop the fact that emotional maladjustment occurs most frequently before or during: the trainee's first dual flight; his first solo flight; his first flight test; and his practice of acrobatics and simulated emergencies.

a. Preparing the trainee for his first dual flight.

(1) If a trainee has had previous flight experience the instructor should carefully explain any differences which either he or the trainee may note between the plane he will be training in and the type of plane he previously had flown.

(2) If the trainee has not had previous flight experience he will probably have a lot of preconceived notions about flying and about the dangers involved in it. The instructor should thoroughly correct these notions before he takes the trainee up for the first time. This should, in fact, be stressed throughout the initial stages of training. Listed below are some of the more prevalent misconceptions that the trainee will bring to the first flight with him:

(a) "That the plane will 'fall' if not constantly given the closest attention or if the engine fails completely."

(b) "That the plane will fall into a spin at the slightest lapse of attention on the part of the pilot."

(c) "That the airplane is maintained in flight through a combination of brute strength and constant violent manipulation of the controls."

(d) See others listed in Chapter III, C.A.B. #5, June 1939, First Edition. (The topic is also discussed in the Third Edition, September 1941.)

(3) The trainee should be given some hints as to what it is going to "feel like," e.g.,

(a) He will feel that the ground is going away from him rather than that he is going away from the ground.

(b) He will get a feeling of lack of motion while he is flying.

(c) Point out the difference in sensations between being in a plane and on top of a tall building.

(d) Explain the abrupt stopping of the roar of the motor when the plane begins a glide.

(4) Emphasize the fact that flying is an everyday occurrence.

(a) The instructor should be casual, unhurried, etc.

(b) If the question comes up, point out that there are very few accidents in airplanes -- especially during flight instruction. A good example to use is to tell him to check up on insurance rates -- they are lower for C.P.T. pilots than the rates against household accidents.

b. Preparing the trainee for his first solo flight.

(1) Ask the class to discuss the preparation of the trainee for his first solo flight. Summarize as follows:

(2) Since a difficulty in the first solo flight is apprehension on the part of the trainee, anything the instructor can do to make the flight "easier" for the trainee will be of value. A good method is to make three or four dual flights around the field during which the trainee familiarizes himself with the ground reference points; air conditions; the proper time to cut the throttle; the time to begin the final approach; etc. If the first solo flight follows these "practice" flights immediately the trainee will know exactly what to do and when to do it, and the excitement and apprehension accompanying the first solo flight will be lessened. (See "Introspective Reports on Learning to Fly an Aeronca Chief Plane.")

(3) Preparing the trainee for his solo flight should begin long before the end of eight hours.

(a) The instructor should try to make the trainee feel that the two of them are working as a team, and that when the time comes for solo, the instructor will have absolute confidence in the trainee's ability to take the plane around and land it.

(b) During the hours before solo, the instructor should give the student practice in meeting simulated emergencies which might confront him on his solo, e.g., forced landings on take-off, and should give the trainee practice in recovering from rough landings, even if he has to nudge the stick and mess up an otherwise good landing. If this is necessary, however, the instructor should always tell the student what happened, and why.

(4) Mention that many trainees, just before the time they expect to solo, go through a period in which their flying suddenly becomes worse.

(a) This may be due to the fact that while they want to solo because of the prestige it brings, they still feel in doubt or apprehensive about trying it by themselves.

(b) Under these conditions the instructor should try to bolster the trainee's confidence by a little extra praise and by emphasizing the fact that he is making his landings unassisted.

(5) The instructor should prepare the trainee for the differences between solo and dual flying, e.g.,

(a) The fact that the plane climbs faster and takes off more easily.

(b) The sense that the front (or rear) seat is "empty."

(c) The fact that the glide will be more flat, and the plane will float farther.

c. Preparing the trainee for his final test flight.

(1) The best method to keep the trainee from getting the "jitters" in his test flight is to give him thorough flight training. The trainee as well as the instructor must feel that he is capable of passing any flight test on the things he has had to date.

(2) "Inspectoritis" will be reduced to a minimum if the trainee is made thoroughly familiar with the flight test situation. This can be accomplished by:

(a) Administering Standard Flights at frequent intervals during the instruction program. These Standard Flights (described in Bulletin No. 1, "Standard Check Flight Procedures") are in reality a series of flight tests appropriate to various stages of instruction. Having had a number of flight tests during instruction, the trainee will be less likely to become "apprehensive" of the final flight test.

(b) Having different instructors administer the Standard Flights as instruction check flights. This will get the trainee used to the idea of check flights and to a new individual flying with him.

(c) Showing the trainee how the flight test differs from most examinations. In flight tests he knows just what is coming and will only be required to repeat his performance on maneuvers which he has been practicing for some 35 hours.

(d) Making certain that the trainee has thoroughly memorized the order of maneuvers appearing in the flight sequences that he will be required to perform.

(e) Suggesting to the trainee that while he is flying solo, he should go through the sequence of maneuvers "making believe" that he is being checked by someone in the other cockpit.

d. Preparing the trainee for acrobatics and simulated emergencies.

(1) Emphasize the fact that neither of these situations should be introduced to the trainee before he is thoroughly prepared for it. They should be discussed and explained, and the trainee should be told how to handle them. Point out that fear is apt to be a primary element in these situations as well as "feelings of incompetence."

(2) Discuss the dangers in taking a trainee up and "wringing him out" on his first flight, or at any time during the course of his training, without telling him beforehand what is going to happen.

(3) Point out the dangers in presenting simulated emergencies before the trainee has been instructed in how to handle the plane in the maneuvers which the emergencies require.

(4) Explain again here that most trainees have preconceived notions about the danger involved in performing acrobatics and about how dangerous emergency situations are. Point out that many of their fears are the result of "suggestion" either from some stories they have heard, or from movies they have

seen. Their fears are none the less real, however, and the instructor must again make every effort to dispel them.

(5) Make the following suggestions for reducing or preventing the development of fear in the presentation of acrobatics and simulated emergencies:

(a) The instructor should tell the trainee beforehand as much as possible about these situations and how to handle them himself.

- If the fear aspects of the situation are emphasized too strongly, the trainee may become afraid in situations which would never have bothered him if the instructor hadn't brought them up -- Suggestion.

(b) The trainee's fears should be openly and frankly discussed. The instructor should point out that fears are perfectly natural, and that a person absolutely without fear would be an extremely unsafe pilot.

(c) NEVER BELITTLE A TRAINEE'S FEARS. The instructor should explain fears to the trainee in the same manner as he does flying.

- In some cases it is useful to show how some maneuver or situation, apparently much worse than the one causing the trainee's fear, is not dangerous.

- Point out to the trainee that his fears may be due to suggestion -- stories he has heard, movies he has seen, etc.

(d) Fear of failure can be offset by the proper use of praise and personal interest. Lower immediate levels of accomplishment should be set so the trainee can see that he is making progress. (See Unit Lesson Plan V.)

(e) If the trainee develops fear or anxiety in some particular maneuver or emergency situation the instructor must try to determine what aspect of the situation is bothering him.

- Discuss the maneuver and flying in general. Try to make it a normal, common, everyday procedure.

- Re-explain every aspect of the particular maneuver and make certain that the trainee understands how to handle it.

- Re-introduce the maneuver or emergency situation gradually, being certain that the trainee knows "what is happening."

(f) The instructor himself should never appear excited or disturbed by certain maneuvers or real or simulated emergencies. He must talk in the same tone of voice as he usually does. He should never take over suddenly.

(g) If a trainee has a minor accident on some maneuver he should be sent up again immediately if at all possible. It may be necessary for the instructor to go up with him, but, in any case, get him back in the air and repeat the maneuver.

V. EVALUATION AND REVIEW

A. Discuss the need for physical and emotional fitness in trainees.

B. Review the problems which might arise in flight instruction because of physical ailments and emotional maladjustments.

C. Evaluate methods for handling these problems.

The following sources, in addition to those listed under "Materials," were used in the preparation of Unit Lesson Plan VI:

"Agents of Impairment," by Johnson, H. M. (A proposed chapter of a text on Aviation Psychology now being prepared by the National Research Council Committee on Selection and Training of Aircraft Pilots.)

"The Effect of Noise and Vibration on Certain Psychomotor Responses," by Lewis, D. Washington, D. C.: C.A.A. Division of Research, Report No. 8. January 1943.

"Maryland Tension Project." A report presented to the N.R.C. Committee on Selection and Training of Aircraft Pilots, January 7, 1943.

STEPS IN TEACHING A TRAINEE HOW TO FLY -- THE FLIGHT INSTRUCTION PLAN

Unit Lesson Plan VII (First Hour)

I. AIMS OF THE LESSON

A. To describe the steps in properly and carefully preparing a flight instruction lesson plan.

B. To demonstrate the steps in instructing a trainee in a specific maneuver, using Medium Turns as a sample maneuver.

II. MATERIALS

- ☐ "Patter" for Elementary Flight Maneuvers, C.A.B. #31.
- ☐ "Flight Instructor's Manual," Third Edition, C.A.B. #5.
- ☐ Revised "Civil Pilot Training Manual," C.A.B. #23.
- ☐ Projector for lantern slides (optional).
- ☐ Lantern Slides of Figs. 45, 46, pp. 88, 89 from C.A.B. #23 (optional).
- ☐ A model airplane with movable controls.
- ☐ A dummy set-up of rudder and stick control.
- ☐ A W.T.S. logbook.
- ☐ Phonograph.
- ☐ Phonograph Records 4, 5, 6, and 7.
- ☐ The outline of the Course of Flight Training in C.A.B.

Reference materials (in notebook):

- ☐ "Fundamentals of Elementary Flight Maneuvers," C.A.B. #32.
- ☐ Charts to be Used as Aids in Lesson Plans, from C.A.B. #23.
- ☐ "The Story Behind the Patter."
- ☐ Sample Page of "Instructor's Personal Logbook for each Trainee."
- ☐ Transcripts of Phonograph Records 4, 5, 6, and 7.
- ☐ Instructor-trainee outline of Flight Instruction Plan.

III. PREPARATION

A. Review the materials carefully and select the demonstration items for this lesson.

B. Prepare for this lesson with particular care as its purpose is to show the instructor-trainees how to prepare for instructing their own trainees.

C. Films and records should be gone over before class so you are familiar with them.

IV. PRESENTATION AND DEMONSTRATION

A. Introduce this lesson by stating that experience in job training in industry has shown that the best results are obtained when the instruction procedures are organized in advance, according to a carefully

worked-out plan. The major steps in teaching a new skill are: (Write these on the board.)

1. Statement of aims or formulation of what is to be taught in a specific lesson.

2. Preparation -- of what to say or demonstrate, and how to do it, including the collection of all necessary materials and training aids.

3. Presentation and demonstration to trainee.

4. Try-out and practice by trainee.

5. Evaluation and review -- to determine how well the task is learned and to review it as a whole.

B. Show the relationship of these steps to flight instruction.

1. Point out that since piloting a plane is a new skill to be learned by a trainee, the same five steps apply to flight instruction.

2. Emphasize that these five steps are nothing new or revolutionary -- that all good instructors go through them whether they know it or not.

3. Make clear that in the following periods the applications of these steps to flight instruction will be discussed, and that techniques which have been found effective by many instructors will be presented in an organized manner.

> CAUTION: Avoid giving the impression that flight instruction heretofore has been wholly bad, and that you are about to tell your class the only right way to instruct.

C. Application of these steps to flight instruction.

1. a. Point out that these "steps in teaching" apply to ground instruction as well as to instruction in the air.

   b. State that before the class takes up their application in teaching a specific maneuver, you will review their general application to ground and air instruction.

2. Make the following points, and allow further suggestions from the class if they are offered:

   a. Aim of the lesson, or formulation of what is to be taught.

(1) Point out the necessity of formulating what is to be taught, or a "statement of aims," before ground instruction.

(2) Contrast this with the instructor's climbing in the plane, and asking trainee, "Well, what did we take up last time?" -- a characteristic of many instructors whose flight lessons were recorded.

(3) Point out that determination of what should be taken up should be in terms of the progress of individual students, and that this decision should be made at the end of the preceding lesson so the appropriate assignment in the "Fundamentals" can be made.

b. Preparation.

(1) Point out to your class that instruction starts long before the instructor meets his trainee. If the instructor is to get across the aim of a lesson, he must have thought out and prepared each step in detail.

(2) The preparation for a flight lesson (whether or not any new maneuvers are to be introduced) includes:

(a) Reference to the outline of the particular course to determine what maneuvers he should be taking up.

(b) Reference to the "Fundamentals" to determine what points the trainee should know and what questions he should be asked to determine if he has read and understood the assigned material.

(c) Determination of the points in his outside preparation to be emphasized in the ground discussion, and additional explanations to be given.

(d) Reference to the "Patter" book, to brush up on the method of explanation, and terminology, during flight instruction.

(e) Collection of charts, models, or other instructional aids to be used during instruction on the ground before the flight lesson.

(f) Outline of what will be taken up in air and ground instruction, the order in which the material will be presented, and the approximate time limits for each topic.

(3) The general lesson plan for any maneuver should be altered to meet the individual needs of a given trainee as determined by reference to the W.T.S. logbook or the instructor's personal logbook for each student.

(4) Point out that until the instructor has gone through these steps, he is not ready to begin the lesson. Your class will probably remark this is a formidable list, and that all their time would be taken up with paper work. Emphasize that when this preparation is organized it becomes much less formidable, and that the purpose of this course is to show how these steps can be carried through in an altogether reasonable time.

c. Presentation and demonstration.

(1) On the ground:

(a) Make clear the distinction between teaching, "telling," and conducting a "bull session." "Telling" does not permit an exchange of ideas, or of questions and answers. "Bull sessions" are unorganized, and though they may be helpful as hangar flying they have no place in the limited time allotted to ground instruction. "Teaching" is a discussion led by the instructor, permitting an exchange of ideas and of questions and answers, but kept on a sequence of planned topics by the instructor so that no important points are omitted. Emphasize that ground instruction should be, if possible, in a quiet place free from distractions.

(b) State briefly that good ground instruction should include the following points:

CAUTION: Do not expand; this material is to be presented in detail later in the lesson.

- The requirements of a given maneuver.

- How it develops from or is different from maneuvers introduced previously.

- How it is basic to maneuvers which are to follow.

- A description of how the maneuver is performed in terms of plane attitude and control operation.

- A statement of plane and ground reference points used during the maneuver.

- An indication of some of the common errors made while learning the maneuver and how to avoid them.

(2) In the air:

(a) Point out the necessity of directed practice and constructive criticisms while in the air.

(b) State briefly that good air instruction should:

> CAUTION: Do not expand; this material is to be presented in detail later in the lesson.

- Be aerodynamically correct.

- Be simple and clear to the student, using no unfamiliar or highly technical terms.

- Be logically organized.

- Include no points which could be handled on the ground before or after the flight lesson proper.

- Be stated so it will have the same meaning for all trainees.

- Include demonstrations which are accompanied by brief instructions making specific mention of plane and ground references.

(c) Emphasize the value of "Patter" as a basis for instruction in the air, since "Patter" was written and then reviewed and rewritten literally dozens of times to meet these standards. (If time permits, expand these remarks through reference to "The Story Behind the Patter.")

d. Try-out and practice by the trainee.

(1) Point out that the purpose of the try-out is to determine if the trainee understands the maneuver and performs it correctly.

(2) Practice is to enable him to make habitual the correct performance of the maneuver.

(a) Emphasize the necessity of directing the trainee's practice in accordance with his particular difficulties. Remark briefly on the points covered in Unit Lesson Plan II, Directed Practice.

(b) Point out that even though a trainee may be performing a maneuver perfectly, continued practice on that maneuver is not wasted since it will reduce the chances for later forgetting, and aid in making control operations "automatic." (Remark that experience in other fields has indicated the value of "overlearning" correct habits.)

c. Review and evaluation.

(1) Point out that review is necessary, since forgetting occurs in learning to fly as well as in other learning situations.

(2) State briefly that evaluation will be dealt with specifically and in detail in a later session. But note here the following points regarding day-to-day evaluation in the air:

(a) The over-all performance of a maneuver should be evaluated first: Whether trainee followed ground reference points; met precision requirements; etc.

(b) The specific errors should then be discussed, e.g., errors in control movements, slipping, skidding, etc., with specific explanation as to how these errors are out of accord with the fundamental principles underlying the maneuver.

(3) Emphasize the importance of a period of review on the ground at the completion of the maneuver, in which the trainee's performance is discussed, the maneuvers to be taken up in the next session stated, and the assignments in the "Fundamentals" and other C.A.A. manuals made.

D. Applications to solo instruction.

1. Make clear that these "steps in teaching" apply in general to solo, as well as to dual, instruction. The ground instruction before solo flights, and the directions to the trainee regarding maneuvers to be practiced and points to be emphasized, require the same preparation and care by the instructor as do dual flights.

2. Point out that unless solo flights are supervised:

   a. They may become merely periods of trial-and-error learning.

   b. They may not even serve the purpose of building confidence, since the trainee may not know how to correct his errors, or worse still, may repeat errors until they become habits.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VII (Second Hour)

Briefly summarize the last hour's work and state that the topics will now be applied to a specific maneuver.

IV. PRESENTATION AND DEMONSTRATION (Continued)

E. State that in this period the class is going to apply these principles to the preparation for teaching a simple maneuver -- Medium Turns, as an example.

1. Bring out that although in actual practice, the "flight instruction plan" has to be altered to meet the needs of individual students, general plans for given maneuvers can be prepared, which can then be altered as required.

2. Take up "Statement of Aims" and "Preparation," and through suggestions from the class outline the method of preparing to teach Medium Turns.

3. Summarize the points developing from the discussion on the board.

F. The following outline will serve as a guide for your organization of the class discussion. Be sure that the points below are covered. Direct the discussion always in terms of the specific example.

1. Statement of aims: Bring out that this involves not merely that Medium Turns are to be taught, but the recognition by the flight instructor that he should plan his instruction so that the integration of Medium Turns into the flight course (the fact that they are basic to many more complex maneuvers) is understood by the trainee.

2. Materials needed by flight instructor.

a. "Flight Instructor's Manual," C.A.B. #31.
b. "Fundamentals of Elementary Flight Maneuvers," C.A.B. #32.
c. "Flight Instructor's Manual," Third Edition, C.A.B. #5.
d. Revised "Civil Training Manual," C.A.B. #23.
e. Charts and diagrams illustrating the requirements for the new maneuver (and often for maneuvers to be reviewed).
f. Trainee's W.T.S. logbook.
g. A model airplane.
h. The instructor's "Personal Logbook," (notes on the trainee's progress).

3. Preparation.

a. Classify the suggestions with reference to preparing to teach medium turns according to the outline for "Preparation" presented under C. 2, (b), page 64.

b. Emphasize:

(1) The necessity of determining at the completion of a given flight lesson the new maneuvers to be taken up in the following lesson, so that appropriate assignments in "Fundamentals" can be made. Bring out that the purpose of the "Fundamentals" is to save the instructor's time, and point out that by handing them out, sheet by sheet, the trainee is more apt to read them than if an assignment is made in the C.P.T. manual.

(2) The necessity for referring to "Patter" frequently. Use both "Elementary Patter" and "Fundamentals" as demonstration material in the class.

(3) The importance of getting ready to quiz the trainee on his outside preparation ("Fundamentals" or other assignments) -- ask for examples of questions that should be asked regarding Medium Turns. Evaluate those suggested.

(4) The value in each instructor-trainee making out in advance a list of the common errors his trainees will be likely to make in performing the maneuvers included in the course he is teaching -- such a list will enable him to have clearly in mind what errors to be on the watch for, and will enable the inexperienced instructor to evaluate a trainee's performance in terms of the number of common errors which he makes.

(a) From class discussion make a list of probable errors of trainees learning Medium Turns.

(5) The value of using diagrams and charts. (If a slide projector is readily available, project slides of Figs. 45 and 46, pp. 88 and 89, C.A.B. #23. If the projector is not available refer the class to the diagrams in the manual.)

(6) The value in instructors keeping a personal logbook of their individual trainee's progress and errors. If an instructor finds that all his trainees are making the same error, some fault in his instruction technique is indicated.

G. Summarize the major headings under "Statement of Aims" and "Preparation." State that although this may seem like a lot of work to require of each instructor before he begins instruction, the efficient instructor will have the major plan for all maneuvers outlined, and for specific lessons will need only to refer to materials which he has already prepared and adapt them to the individual trainee.

H. Play Phonograph Records 4, 5, and 6 (examples of good ground instruction previous to the flight lesson, and instruction in the air, in Medium Turns).

1. Discuss with the class how ground instruction developed from points brought up under "Preparation." Bring up the good and bad points in the instruction, e.g.,

a. Good points.

(1) Instructor asked trainee questions regarding his outside assignments.

(2) Instructor developed points on which trainee appeared uncertain.

(3) Explanations were in simple terms.

(4) Instructor emphasized safety and precision.

b. Bad points.

(1) Too many aerodynamic principles may have been discussed.

2. Discuss with the class the way in which the instruction in the air was integrated with the pre-flight ground instruction. Bring out the good and bad points in the example, e.g.,

a. Good points.

(1) Few explanations of technical points which could have been better included in ground discussion.

(2) References were made to ground discussion during instruction in air -- e.g., regarding control movements, reference points, etc.

b. Bad points.

(1) Instructor may have talked too much during first demonstration of the maneuver.

I. State that in the next period the class will begin to make Flight Instruction Plans for the maneuvers they will teach as instructors in the field.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VII (Third Hour)

If there has been an extended lapse of time between the second and third hours of this lesson present a brief summary of the topics discussed during the previous hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

J. 1. Open the class by stating that in this period the "Statement of Aims" and "Preparation" sections of Flight Instruction Plans for secondary maneuvers will be made.

2. Write on the board the items that should be covered in "Statement of Aims," "Materials," and "Preparation" (see C, 2, (a) and (b)). Have the class copy these lists in their notebooks.

3. State that in making up generalized Flight Instruction Plans, reference to individual trainees is obviously impossible, and that, therefore, instead of listing the errors made by given trainees, the class should prepare lists of all the errors they can think of which a trainee might make in the process of learning the specific maneuvers. Instruct the class that the errors should be classified according to the frequency with which they might be expected to occur.

4. Let the instructor-trainees select the maneuver they want to work on in class, but state that Flight Instruction Plans <u>for all maneuvers</u> they will be required to teach will be prepared by each individual as an outside assignment.

5. Assign a due date for these lesson plans to be submitted, and remind your class that the final grade assigned to each instructor-trainee will depend in part on the excellence of the Flight Instruction Plans he submits.

6. State that Flight Instruction Plans should be submitted typewritten if possible, or written legibly in ink, so that they will be permanent records for later reference.

K. During the period circulate through the class, making comments on the preparations of the instructor-trainees, and offering help where requested.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VII (Fourth Hour)

If there has been an extended lapse of time between the Third and Fourth Hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

L. 1. Begin the class by stating that in the past class periods the Preparation for the flight lesson has been discussed.

2. Point out that actual instruction is the PRESENTATION and DEMONSTRATION in the teaching situation of the materials and procedures dealt with under "Preparation."

3. Have an instructor-trainee act as "instructor" and give ground and air instruction to another man acting as "trainee," in one of the maneuvers prepared for in the previous day's lesson. If possible, get two demonstrations into the hour class period. Confine each demonstration to a single maneuver in order to save time.

4. Ask for class criticism of the instruction (at the completion of the "ground" and of the "air" instruction) and discuss the degree to which the instructor-trainee covered the following points in his presentation:

a. Ground instruction:

(1) Trainee should be told the air work to be taken up, and the way the maneuvers are related to other more complex maneuvers. ("Statement of Aims" of the lesson.)

(2) The good points, and errors, in the trainee's previous lesson should be discussed, with particular reference to errors which would be likely to appear in the maneuvers to be demonstrated. Reference should be made to the list of common errors made up earlier.

(3) The requirements of the maneuver should be discussed, e.g., degree of bank, amount of turn, <u>with specific reference to the precision requirements and safety precautions</u>.

(4) The trainee should be quizzed on his knowledge of outside assignments, particularly the "Fundamentals." His weak points should be elaborated on, and the material in the "Fundamentals" reviewed. The points dealing with <u>safety</u> and <u>precision</u> should be emphasized.

(5) A verbal description of the maneuver and how it is performed should be given, using a model plane and charts for demonstration if possible. The use of reference points, on the plane and on the ground (roads, fence-lines, etc.) should be mentioned. General aerodynamic principles may be brought in, but the instructor should not go into the fine points. Keep it simple. The length of their description should depend on the degree to which the trainee understands the material in the "Fundamentals."

(6) The previously demonstrated maneuvers which are to be practiced in the present lesson should be reviewed.

b. Instruction in the air: Be sure that the points included under Presentation, Section C, 2, c are covered. In addition, note the following points:

(1) Before taking off, the instructor should make sure the trainee goes through all routine checks and knows why he is doing it.

(2) On the way to the practice area the instructor may profitably discuss the maneuvers to be taken up, point out reference points on the plane to be used during the maneuver or let the trainee practice coordination exercises.

(a) Occasionally, however, it is helpful to let the trainee fly as he pleases (to let him "play around" a bit) on the way to and from the practice area, so he won't get the idea his training is standardized to the degree that he must do only what the instructor tells him to, and nothing on his own initiative.

(3) During the presentation and demonstration the precision requirements of the maneuver should be stated clearly and emphasized.

(4) Safety precautions should be emphasized.

c. If the instructor-trainee's instruction "in the air" is not clear tell him to read aloud the instructor's "Patter" for the given maneuver from the "Patter" book and to note the improvement in clarity of explanation. This will bring out to the class the usefulness of this bulletin.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VII (Fifth Hour)

Begin the class by stating that the last period dealt with ground and air instruction or "Presentation." State that in this session practice of maneuvers will be discussed, and evaluation and review of performance taken up.

IV. PRESENTATION AND DEMONSTRATION (Continued)

M. Practice.

1. Point out the importance of <u>try-out</u> and <u>practice</u> immediately following demonstration, and the importance of continued practice even after the trainee appears to have mastered a maneuver.

   a. Point out that unless practice immediately follows the demonstration, forgetting of fine control pressures may take place.

   b. Emphasize, however, that this does not mean long <u>consecutive</u> practice on a given maneuver but rather practice spread out over a number of lessons.

   c. Emphasize the danger of continued practice of a maneuver with which the trainee is having difficulty. It is better to analyze his errors and discuss their correction later, on the ground.

2. Point out again the importance of directed practice, emphasizing its significance particularly in solo practice.

3. Make it clear that in dual instruction, practice by the trainee, and evaluation of his performance by the instructor, take place simultaneously.

N. Evaluation and review.

1. State that the topic of evaluation will be taken up in detail in the following periods, but that you want to discuss it briefly in the present lesson.

2. Present for class discussion: "How should the day-to-day evaluation by the instructor be organized?" Bring out the following points:

   a. The trainee should first be asked to evaluate his own performance, and the instructor's comments guided by the trainee's understanding of his errors.

   b. The over-all performance should be analyzed first and commented on to the trainee, emphasizing its good as well as its bad phases. Attention to over-all performance is particularly important after the first demonstration of a maneuver.

c. After the over-all evaluation the specific errors of the trainee should be taken up, their effect on the over-all performance discussed, and methods of correcting them stated.

d. The rate at which errors have dropped out during the practice of previously demonstrated maneuvers should be noted and commented on. Whenever possible the trainee should be complimented on specific improvements in his performance.

e. Use of instruments by the instructor to check his observations. Point out the difficulty of detecting slight slips or skids without reference to the ball-bank indicator.

f. The instructor should take written notes on the trainee's performance for use in the discussion on the ground, after the lesson.

3. Present for discussion: "What are the major inadequacies in the usual review of the trainee's performance?" Outline the class suggestions on the board, and be sure to cover the following:

a. Inaccurate observation of the trainee's performance, due in part to failure to check observations by use of instruments.

b. Incomplete observation of trainee's performance due to lack of an organized routine of observation and failure to take notes while in the air.

c. Differences of opinion between instructors as to the importance of various maneuvers, or the important aspects of given maneuvers, and the emphasis of certain instructors on "pet peeves."

d. The tendency to consider that because a trainee is good in one maneuver he is good in them all.

e. The difficulty of comparing estimates of the performance of a given student by two instructors, since what is "average" to one may not be average to the other.

4. State that in the following periods, the use of the "Ohio State Flight Inventory" and other methods for overcoming certain of these inadequacies will be discussed. Point out again the value of a "personal logbook" in which the notes made on a trainee during his flight lesson can be summarized. See the suggested form for use with pages or cards which could be mimeographed by the instructor or flight operator. These comments should serve as a point of departure in preparing the next day's flight lesson.

a. Such a form has the following advantages as a supplement to the W.T.S. logbook.

(1) Notations can be more extensive and specific than the one in the W.T.S. logbook.

(2) Comments of a personal nature which should not be seen by the trainee or unauthorized persons may be entered.

(3) The details of every trainee's performance don't have to be "remembered."

5. The importance of review should be emphasized. State that review can be thought of as taking two forms:

a. Review in the air, in which the instructor demonstrates again maneuvers which have been introduced earlier, emphasizing in his review the aspects of the maneuver in which the trainee was inadequate. Point out that during such demonstrations it is often helpful to direct the trainee's attention outside of the plane, to ground reference points, so that he gets the "feel" of a properly executed maneuver.

b. Review on the ground, after the flight lesson, during which the good and bad points of the trainee's performance are discussed.

(1) Emphasize the importance of analysis of the trainee's performance in these post-lesson ground discussions, and the assignment of new maneuvers to be taken up in the next lesson in the light of the trainee's progress.

(2) Play Phonograph Record 7 (good post-flight ground instruction). Ask for class comment and discussion of this example.

V. EVALUATION AND REVIEW OF LESSONS ON FLIGHT INSTRUCTION PLAN

A. Emphasize the Steps in Teaching.

B. Emphasize the importance of making a Flight Instruction Plan for directing the training of individual trainees in accordance with their individual needs.

C. Emphasize the importance of ground instruction, before and after the flight lesson. Make the point that all instruction possible should take place on the ground.

D. Point out the value of the "Fundamentals" and the "Patter" book. Emphasize that the assignments in the "Fundamentals" should be made at the end of a given lesson, for study before the time of the following flight lesson.

E. Point out the advantages of careful evaluation of the trainee's day-to-day progress.

FINDING OUT HOW THE TRAINEE IS PROGRESSING

Unit Lesson Plan VIII (First Hour)

I. AIMS OF THE LESSON

A. To discuss the problems involved in accurate evaluation of trainee progress.

B. To present methods and techniques used in trainee evaluation.

II. MATERIALS

- ☐ Motion Photograph Projector
- ☐ Motion Photograph of good and bad performance on selected maneuvers from a Flight Test, Reel 2.
- ☐ "Flight Instructor's Manual," C.A.B. #5, 3rd edition.
- ☐ "Civil Pilot Training Manual," C.A.B. #23, 2nd edition.
- ☐ "C.P.T. Pilot Rating Book," (W.T.S. logbook).
- ☐ "Manual for Administration of the Ohio State Flight Inventory."
- ☐ Copy for each member of the class of the "Ohio State Flight Inventory."
- ☐ Flight Instructor's Recommendation or Pilot Flight Test Report; ACA 342A.

Reference Materials (in notebook):

- ☐ Sample page of "Instructor's Personal Logbook for Each Trainee."
- ☐ Photograph of C.A.A.-N.R.C. Piper Cub Instrument Panel.
- ☐ Photograph of Friez Flight Analyzer.
- ☐ Photograph of "The Flight Recorder."
- ☐ Photograph of R-S Ride Recorder and a Tentative Scale for Rating Performance on the Right 720° Power Turn.
- ☐ A Sample Diagram of Sequence of Maneuvers for Final Check Flight.
- ☐ A Sample of an Early Flight Inventory.
- ☐ Record Sheet for Analysis of Practice Flight Observations.
- ☐ "A Preliminary Study of Certain Predictors of Success in Civilian Pilot Training," by Kelly, E. L. and Ewart, E.
- ☐ Standard Check Flight Procedures.
- ☐ A Description of Motion Photograph of good and bad performance on selected maneuvers from a Flight Test, Reel 2.
- ☐ "Scale for Rating Pilot Competency."

III. PREPARATION

A. Study the lesson outlines and reference materials.

B. Prepare the "Practice Flight" required for the third hour of the lesson, in accordance with local conditions and time available.

IV. PRESENTATION AND DEMONSTRATION

A. Introduction.

1. One of the Major Steps in Teaching discussed previously was "Evaluation and Review." This step required an analysis of

the trainee's performance in order to point out the good and poor aspects and to help him develop correct habits and avoid (or break) incorrect habits.

2. Another reason for accurate analysis of trainee performance is to yield a measure of his performance. This measure, in terms of a grade or some other form of rating, enables the instructor to compare the trainee's performance against a desired standard or against the trainee's previous performance in order to find out how the trainee is "getting along."

B. Need for an Accurate Measure of Pilot Performance: One difficulty in the past has been the lack of agreement as to standards and methods of rating student performance.

1. In one study a group of C.P.T. trainees were rated at the end of their primary flight training by three persons -- their instructor, a check pilot, and one of three C.A.A. inspectors. (See reference at end of this lesson.)

a. The agreement of inspectors, with instructor or check-pilot, was little better than could have been expected by chance -- i.e., was little better than if the raters had never flown with the trainees, but had merely given them the first grade that happened to pop into their minds.

b. The agreement between instructors and the check-pilot was somewhat better, i.e., some relationship between their ratings was evident.

2. Possible causes of the lack of relationship between inspectors and instructors or check-pilots are:

a. The fact that a trainee's performance on a single flight may not be representative and hence may give an incomplete picture.

b. The differences in emphasis on certain maneuvers between instructors and inspectors.

c. The lack of standardization in check flight procedures.

3. Cite examples of differences among inspectors as to "what they look for," what they "grade on," etc. Refer to common practice of preparing the trainee to "pass the inspector" rather than the course.

C. Sources of Error in Judging Performance: Present for class discussion: "What are some of the common sources of error in giving flight grades, or maneuver ratings as entered in the logbooks?" During the discussion bring out the following points:

1. Differences between raters as to standards:

   a. The "tough" grader.

   b. The "easy" grader, etc.

2. The avoidance of extreme ratings:

   a. Some instructors don't give 1's or 5's on "general principles."

   b. Inspector's grades show the same tendency.
   Example: In one study of inspector's grades (see reference at end of this hour), out of a total of 36 students --
   21 obtained grade of 80
   11 " " " 75
   4 " " " 70

3. Tendencies to shift standards:

   a. From day to day according to mood.

   b. From stage to stage.

   c. From trainee to trainee. For example, an average trainee rated immediately after an outstanding trainee may receive too low a rating.

4. Basing judgments on <u>inaccurate</u> data:

   a. Inaccurate judgments of angle of bank, air speed, etc.

   b. Failure to check against available instruments.

   c. Failure to remember afterwards what really happened.

5. Failure to <u>observe</u> the significant items:

   a. Instructor's "look for" pet faults and "just don't see" others.

   b. Instructors and inspectors use different test situations.

6. Differences of opinion as to importance of the items observed:

   a. Differences as to significance of the various maneuvers.

   b. Differences as to significance of specific faults, such as slipping, skidding, climbing speed, etc.

D. On the basis of the above discussion of errors it can be seen that an accurate measure of performance will be obtained only if the following three conditions apply:

1. The performance being evaluated is made under carefully standardized conditions.

2. The observer makes complete and accurate observations of the performance.

3. The grading system is clearly defined in terms of standards of performance and in terms of the items observed.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VIII (Second Hour)

If there has been an extended lapse of time between the First and Second hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

E. Introduction: Point out that during the last hour the importance of standardization of the test situation was emphasized. State that this topic will be taken up in detail during this session.

F. Tendency toward standardization of flight instruction in general.

1. Point out that the trend in flight instruction has been and is now toward standardization and away from the haphazard and unsupervised practices of the past. This is shown by:

a. The organization of the C.P.T.-W.T.S. curricula.

(1) Flight course curricula.

(2) Preparation of C.A.A. manuals.

(3) Ground-school courses.

b. Standardization of instruction.

(1) By instructor refresher courses.

(2) The standardization of terminology and instruction by the use of "Patter."

(3) The development and use of "Fundamentals of Flight Maneuvers."

G. Standardization of C.A.A.-W.T.S. tests.

1. Standardization of ground-school tests. Point out that standard tests have been prepared so that all trainees completing certain courses will be questioned over the same material.

2. Standardization of flight tests. Go over sample flight tests, and point out the attempt to standardize the examination in terms of maneuvers included, requirements of the maneuvers, order of presentation, etc. Refer to "A Sample Diagram of Sequence of Maneuvers for Final Check Flight," included in the reference material.

H. Use of standard flights in flight instruction.

1. The principle of standardization of flight tests is exemplified by the Standard Check Flight Procedures developed for research

purposes at the University of Pennsylvania under the direction of the National Research Council.

2. Pass out copies of "Standard Check Flight Procedures" and discuss the following points:

   a. Basic characteristics of the standard flight.

   b. Adaptation to local airports.

   c. Instructions for use of Standard Flights. The principles of these instructions hold true for any standard sequence of maneuvers.

3. Precautions to be observed in teaching and using any standard sequence.

   a. Trainees must be cautioned that field patterns are not identical from airport to airport. They may be altered because of obstructions or restricted areas.

   b. Trainees must be taught that in emergencies, e.g., forced landings, the sequence does not have to be followed.

   c. The instructor must be careful not to follow a set routine of inserting emergency maneuvers at the same point in the sequence.

   d. Trainees must be taught the reasons for the flight patterns and sequence of maneuvers and trained to plan flight paths in accordance with the pattern and sequence.

4. Outside assignment.

   a. Have the class prepare a description and diagram of Standard Flight A as adpated to the local airport being used in connection with this course.

      (1) This may be helpful in planning new field patterns necessitated by emergency conditions, e.g., weather, restricted areas, etc.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VIII (Third Hour)

If there has been an extended lapse of time between the second and third hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

K. Begin this hour by explaining that it is not sufficient merely to put the trainee in a standardized test situation. What he does during the test must be observed and evaluated by the person giving the test. In previous discussions it was shown that inaccurate evaluation of trainee performance was due to three main causes:

1. Failure to look for the right things.

2. Failure to record accurately what was observed.

3. Failure to evaluate the performance adequately, either for the trainee's benefit, or for grading purposes.

L. Reduction of errors of observation and evaluation: Raise the question of how such errors can be reduced. Try to integrate the suggestions of the class with the following points:

1. The development of an organized method of observation such as the following:

a. Break-down of the performance into logical parts (such as entry, turn, and recovery), noting certain specific points during the trainee's execution of each part. Emphasize that the nature of errors can most accurately be noted in terms of specific aspects of performance (leads with rudder in entry) rather than in terms of general characteristics (poor coordination). Example of such a break-down:

(1) Control operations.

(a) Errors in application of pressures.

(b) Errors in timing.

(2) Precision.

(a) Errors in maintenance of direction, rate of turn, angle of bank, etc.

(b) Errors in altitude control.

(c) Errors in ground pattern.

(3) Judgment and planning.

(a) Failure to show evidences of having planned flight path.

(b) Failures to observe safety precautions.

b. Use of available instruments for checking observations.

c. Use of an organized method of recording the observations.

d. Practice in the use of the method developed.

2. Development of an organized system of evaluation, based on the observations made during the flight.

a. The over-all performance on the maneuver should be evaluated first.

b. Then the specific faults in the performance should be analyzed and the effect of such errors on the over-all performance pointed out.

c. When evaluation of flight performance is made in terms of comparison with other trainees, or to determine a given trainee's progress for entry in W.T.S. or the "Personal" logbooks, the following points, in addition to performance during a given flight, should be noted: (Ask class for other suggestions.)

(1) Application of principles learned in previous maneuvers (e.g., safety precautions, correction for drift, etc.)

(2) Recognition of new variations of previously learned control applications.

(3) Rapidity with which errors drop out with continued practice on certain maneuvers.

(4) Persistent recurrence of old errors.

(5) Speed with which the trainee "catches on."

M. The problem of rating flight performance.

1. Point out that the W.T.S. Logbook calls for ratings, after each flight, of the trainee's performance on all maneuvers practiced during that flight. These ratings are made in terms of a grading system having a range of five points, as follows:

1. Excellent
2. Above Average

3. Average
4. Below Average
5. Poor

2. State that the purpose of any rating system is to differentiate individuals in respect to the performance on which they are being rated. In the flight instruction situation, the rating system is designed to bring out differences in flying proficiency which exist among trainees.

   a. In order for differences to be made most clear, as much of the total range of ratings as possible should be used.

      (1) Contrast this point with the tendency of many flight instructors to rate their trainees using only two or three of the five possible ratings.

      (2) Point out that in the experiment cited earlier in this lesson, 32 out of 36 trainees were given a grade of either 75 or 80, which did not differentiate between individual trainees but merely lumped them into two groups.

3. Point out that the rating or grade given to a trainee will depend on the standard of performance with which he is being compared.

   a. Point out that two standards could be used in rating a group of trainees, i.e., the performance of individual trainees in the group could be compared with:

      (1) The performance of a large group of trainees who had completed the flight course.

      (2) The performance of a large group of trainees having the same amount of training as the man being rated.

   b. Mention the advantages and disadvantages of these two types of standards:

      (1) Standard: Proficiency at end of course.

         (a) Advantage: Improvement can be shown by the progressive improvement in rating from stage to stage.

         (b) Disadvantage: The entire range of ratings will probably not be used in rating trainees at any one stage, e.g., during Stage A, even the best trainees would seldom be rated better than 3 on certain maneuvers.

(2) Standard: Proficiency of a group having same amount of training as those being rated.

(a) Advantage: The entire range of ratings can be used in rating a group of trainees at any stage in their training.

(b) Disadvantage: Improvement is not so readily shown, since the trainee who improves normally will show no improvement in his ratings from stage to stage.

4. Bring out that W.T.S. officials have stated that ratings are to be made in terms of what could be expected of a group of trainees having comparable training to those being rated.

> CAUTION: Check this point with your resident supervisor. W.T.S. procedures change from time to time.

a. Point out that the "standard" against which trainees being rated are to be compared is represented best by the various levels of performance the instructor has found in previous trainees he has instructed.

(1) Bring out the difficulty this presents to the new instructor. Point out the following aids in setting a standard until experience has been gained:

(a) The new instructor may use as a tentative standard the performances of the men with whom he trained, in various C.P.T. courses.

(b) The instructor can refer to his list of errors commonly made in a specific maneuver. The number of these errors made by a given trainee can then be considered in giving him a rating.

b. Again emphasize that when this standard (comparison with the group) is used:

(1) Average progress from stage to stage will be indicated by similar ratings from stage to stage, and not by improvement in ratings.

(2) The entire range of ratings should be used, so that the greatest possible differentiation between trainees may be made.

(a) Point out that if a large group of trainees were being rated on a given maneuver there should be 1's and 5's as well as ratings of 2, 3, and 4. This is because in a large group of trainees with equal number of hours of flight there must be some who are outstandingly good and others who are outstandingly bad.

(b) Emphasize that every small group of trainees may not contain very good or very poor trainees, so that the instructor should not "force" his ratings. He should remember, however, that 1's and 5's are included in the scale, and therefore should be used in rating the extremely good, and the extremely poor trainee, respectively.

c. Bring out the implications of such ratings for training.

(1) Emphasize the inaccuracy of the statement made frequently by instructors, "If a trainee is rated 1 he would be perfect so there would be no use of training him further."

(a) Point out that just because a trainee is given a 1 in a maneuver in Stage A does not imply that more improvement is impossible. It merely indicates that in comparison with others having the same training, the trainee's performance is extremely good.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VIII (Fourth Hour)

If there has been an extended lapse of time between the third and fourth hours of this lesson, present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

N. Introduction. Point out that ratings can be used for two major purposes:

1. To grade the trainee's performance, i.e., for marking purposes.

2. As an aid in instruction, i.e., to help in identifying those details of flight which need correction, or further practice, etc.

O. The "Flight Instructor's Recommendation or Pilot Flight Test Report" (Form ACA342A) is an example of a method intended primarily for grading or rating purposes.

1. Point out that this is an attempt to overcome some of the weaknesses of past instructor and logbook ratings.

2. Demonstrate how the ratings are made (see directions on the sheet).

3. Emphasize that this instrument is primarily a rating or grading device rather than an instructional aid although it may have some usefulness in this latter connection.

4. Point out that it is possible to fill out this form from "Flight Inventory" notations which are discussed below.

P. The Ohio State Flight Inventory is an example of a rating form intended primarily for instructional purposes although it can also be used for grading and, as a matter of fact, for obtaining facts used in preparing the "Flight Instructor's Recommendation" (Form ACA342A).

1. Present samples of early form of inventory and show the following weaknesses. (See "A Sample of an Early Flight Inventory" in reference materials.)

a. Too many items, some only infrequently marked.

b. Some items were "pets" of individual instructors.

c. Difficulty of observing some of the items.

2. Present latest revision of "Ohio State Flight Inventory" and show: (See "Manual for Administering Ohio State Flight Inventory.)

   a. Reduction in number of items.

   b. Applicability to many types of planes, instruction programs, etc.

   c. Present method of scoring.

   d. Use of Inventory as analytical aid in detecting "families" of errors, e.g., insufficient rudder in all turns.

   e. Point out that the appearance of the same family of errors in several of an instructor's trainees may indicate a deficiency in the instructor's methods of teaching and evaluation.

3. Point out that the "Ohio State Flight Inventory" can be discussed with the trainee following each check flight on which it is used.

4. Contrast the "Ohio State Flight Inventory" with the "Flight Instructor's Recommendation" (Form ACA342A) mentioned above.

   a. Emphasize the point that the Inventory is more specific in indicating errors. For example: If a trainee skids on right turns and not on left turns there is no possibility of indicating either the direction of the turn or in which part of the turn the skid was made if the "Flight Instructor's Recommendation" blank is used. When the "Ohio State Flight Inventory" is employed, however, the instructor may indicate whether the error is made consistently on right or left turns, on entry or recovery, and if it is due to overcontrol or undercontrol. (Other examples may be used.)

   b. Point out how the Flight Inventory can help to solve the problem confronting the inexperienced instructor in determining just what constitutes a "good," "average," or "poor" trainee, since evaluation is in terms of <u>observed</u> performance rather than ratings.

   c. Point out that the "Ohio State Flight Inventory" emphasizes the trainee's good points as well as his errors. Show how this ties in with good instruction.

   d. Show how the trainee himself may make use of the "Ohio State Flight Inventory" as well as the instructor.

Q. Tryout and Practice (to be carried on outside of class).

1. A sample flight, consisting of eight or ten maneuvers from Standard Flight A, will be devised under the Methods Instructor's direction in accordance with the principles of the "standard flight."

2. Each Instructor Trainee will select for each maneuver two of the possible "errors" listed on the "Ohio State Flight Inventory" sheet for that maneuver. The "errors" selected should be reported in writing to the Methods Instructor and not mentioned to anyone else.

3. The class will then be divided into groups of three: Trainee A, Trainee B, and Trainee C. Each group will go through the following procedure:

> CAUTION. Be certain that these instructions are understood.

a. Trainee A, acting as pilot, will pilot the plane through the "trial flight," making the predetermined errors at the appropriate time. (The errors should not be exaggerated but performed as "naturally" as possible.)

b. Trainee B, accompanying the flight as observer, will assign a grade for each maneuver on sample sheets of a standard Logbook, making all pertinent entries and comments.

c. With Trainee A as pilot and Trainee B as observer, a second flight will be made. Trainee A will make the same predetermined errors. Trainee B will use the "Flight Inventory," following the standard procedure for its use.

d. Two flights, according to a similar procedure, will then be made with Trainee C as observer and Trainee A as pilot.

e. If time allows, other possible combinations can be used, as follows:

B as pilot, C as observer
B as pilot, A as observer
C as pilot, A as observer
C as pilot, B as observer

4. The Logbook entries and Flight Inventories will be turned in to the Methods Instructor, properly identified as to Pilot and Observer.

Make a brief summary of the topics discussed during this hour.

CAUTION. The data from these flights will be used in the Sixth Hour of this lesson. If the experimental flights have not been completed by this time begin Unit Lesson Plan IX in place of the Sixth Hour and come back to it when all Instructor-Trainees have complete data.

Unit Lesson Plan VIII (Fifth Hour)

If there has been an extended lapse of time between the fourth and fifth hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued).

R. Begin this hour by discussing the following points:

1. One difficulty of Evaluation of Flight Performance by an observer in the plane is that once the flight is over, it can't be repeated. An observer has no way of "checking" on himself and, unless the plane can carry more than one observer, observers can't check on each other.

2. Because of the above, attempts have been made to obtain a permanent record of flight performance which can be studied on the ground after the flight.

3. Two methods have been used: Photographic and graphic. The former involves taking a motion photograph of the flight. The latter uses an instrument which keeps a permanent record of various aspects of flight performance.

C. Photographic Method of Analysis of Flight Performance.

1. The best example of the use of photographic analysis is found in a method devised at the University of Pennsylvania and used in connection with the N.R.C. Midwest Project which included:

   a. Photographic Recording of C.P.T. students during Standard Flights in Stages A, B, C, and D.

   b. Rating of the over-all performance on the basis of an inspection of the films by two independent observers, who placed the students into Best 25%, Middle 50%, and Poorest 25% on basis of films alone.

2. Description of the photographic records obtained.

   a. Camera Field: (Show "Photograph of C.A.A.-N.R.C. Piper Cub Instrument Panel" and describe the items in the camera field.)

   b. The Pennsylvania Control Recorder.

   c. The method of taking the photographs.

3. Demonstration of Motion Photograph, Reel 2.

   a. Pass out to the class "A Description of Motion Photograph of good and bad performance on selected maneuvers from a Flight Test," Reel 2.

   b. Present Reel 2, which contains two flights; the first representing a good performance on the selected maneuvers, and the second representing a poor performance. After the film has been run, ask the class to consider which of the performance was the better of the two and why.

4. Re-run the film and make specific observations on sample maneuvers, (Methods Instructor -- see comments on Demonstration Film I.) Point out the difficulty of observing <u>all</u> items during one viewing and the differences between individuals in the class as to the observations they reported.

T. Values of photographic records of pilot performance.

1. Permit viewing and re-viewing until all possible observations are made.

2. A trainee's errors can be pointed out to him <u>on the ground</u> when he is not distracted by other duties.

3. More than one person can observe the performance at the same time.

4. An instructor can check his own accuracy in observing trainee performance.

5. Instructors can check their <u>own</u> flying habits to insure that they are demonstrating maneuvers properly.

6. Use of these instruments is limited by their cost, time necessary to process the films, necessity for "photographic plane," etc.

U. Graphic recording of pilot performance.

1. Refer to the following photographs and descriptions in the Reference Materials (in the Notebook):

   a. The R. S. Ride Recorder and Sample Records.

   b. The Friez Flight Analyzer.

   c. The Flight Recorder and Sample Records.

2. Describe the flight data provided by each of the above instruments.

3. Evaluation of graphic records of performance.

   a. Same general advantages as photographic records.

   b. Less costly than film.

   c. Harder to analyze since records are in different form from that ordinarily observed.

   d. Recording limited to a few aspects of trainee's performance.

   e. Maintenance of this apparatus is difficult.

V. Present a brief discussion of the status of these techniques.

1. As yet, the photographic and graphic methods of recording and analyzing flight performance (discussed in previous sessions) are not available or practical for every-day use. Analysis of trainee performance still is dependent upon direct observation during flight. In the meantime, such methods are available for research purposes and field try-out as instructional and flight evaluation aids.

2. The <u>immediate</u> problems of instructors is to improve their own observation, utilizing all possible aids.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan VIII (Sixth Hour)

If there has been an extended lapse of time between the Fifth and Sixth Hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

CAUTION: If all Instructor-Trainees have not completed their experimental flights as called for in the Fourth Hour of this lesson, begin presenting Unit Lesson Plan IX at this time.

W. Comparison of Logbook and Flight Inventory Observations: On the basis of class comments and data obtained during the "practice flights," the Log Book and Flight Inventory methods of observation should be discussed and evaluated, and the following differences emphasized:

1. Observation of intentional errors.

a. Tabulate the data from the "Practice Flight" experiment using the "Record Sheets" provided.

b. Treat each maneuver separately, and determine what percentage of the total number of intentional errors made by your trainees during their "practice flights" were recorded in (1) the Logbook observations, and (2) the Flight Inventory checks, respectively.

--For example: If you have a class of 30 trainees, each man should have completed two flights, making the same two intentional errors in each maneuver of each flight. Thus there would be 60 intentional errors made in a single maneuver during flights in which the observers used the W.T.S. Logbook, and the same 60 intentional errors would be made during the flights in which the observers used the Flight Inventory.

c. Checking the "Logbook" entries against the errors intentionally made by the pilot will reveal how many of the 60 were "caught" by the observers.

d. Checking the "Flight Inventory" observations against the errors intentionally made will provide a similar comparison.

e. Compare the efficiency of the two methods in terms of the success with which each recorded the intentional errors made. (Tabulation of data on three or four maneuvers should be sufficient for illustrative purposes.)

2. Completeness of observation: It will undoubtedly be possible to contrast tendency of Logbook entries to be concentrated on a few items with the Flight Inventory which compels observer to examine many aspects of the performance.

3. Comparative merits of the two systems for instructional purposes (as discussed in outline for Fourth Hour of this lesson).

4. Comparative merits of the two systems for grading, or rating purposes (as discussed in outline for Fourth Hour of this lesson).

V. REVIEW AND CONCLUSION.

A. Accurate measurement of trainee's progress requires:

1. Standardization of the test situation.

2. Complete and accurate observation of performance during the test situation.

3. Use of a grading or rating system with well-defined standards and methods of grading.

B. The accuracy of measures of trainee's progress can be improved by means of the following techniques:

1. Use of Standard Flights.

2. Training in the avoidance of common errors of observation and evaluation.

3. Use of Flight Inventories for analysis and scoring of pilot performance.

4. Use of graphic and photographic methods (in research).

CHECKING FLIGHT INSTRUCTOR PRACTICES

Unit Lesson Plan IX

I. AIMS OF LESSON

A. To stress the need for a periodic check-up on instruction methods.

B. To describe the use of the "Instructor's Self-Audit," a systematic evaluation of daily instruction practices.

II. MATERIALS

Reference materials (in notebook):

- ☐ "Self-Audit for Flight Instructors."
- ☐ U.S. Navy "A Diagnostic Scale for Rating Flight Instructors."
- ☐ "How'm I doin'?" by M.S. Viteles.
- ☐ Suggested questions to be assigned prior to the final examination.

III. PREPARATION

A. Review the above-listed materials, and how they are used.

IV. PRESENTATION AND DEMONSTRATION

A. Begin the hour by presenting the need for a periodic check-up of the instructor's teaching practices.

1. Point out that checking on the instructor's teaching practices is just as important as giving the engines their 100-hour checks; or giving the trainees their check flights.

2. Discuss the following reasons for periodically checking on instruction practices.

a. The present course will be of value only to the extent that it is carried over into practice. The use of outlines and instruction aids, and the constant attention to the avoidance of common errors of instruction, must become habitual with the instructor.

b. Refer to the fact that a personal check on one's habits has been used to advantage in industry under the title of the "Self-Audit" plan. The function of the self-audit plan is to direct the man's attention toward his own work, to encourage him to review his own working practices, and to correct any faults which he discovers in them. Use the forms attached to "How'm I doin'?" as illustrative material.

c. As the instructor becomes more experienced he is likely to slip into some bad teaching habits without actually being aware of it. The fundamental idea behind the self-audit procedure is that even the man who knows how to do

the job, and who is eager to do the job well, frequently slips into careless or neglectful ways of doing it without becoming aware of the change in working habits which has taken place. Refer to the material on driving an automobile, pp. 2-3 of "How'm I Doin'?" as an illustration. Ask the class to suggest similar illustrations in terms of instruction habits.

d. Check-ups are particularly necessary with the beginning instructor since he is still learning to teach. It cannot be assumed that his teaching practices are adequate simply because he can fly.

e. The beginning instructor is likely to become overwhelmed with all the "things not to do and things to do" and will say to himself, "If I have to think of all these things when I teach, I won't be able to teach at all." A systematic check-up will enable him to keep the principles in mind -- to make certain that they are still being applied -- that no bad habits have replaced good ways of teaching.

B. Methods of checking on instruction practices.

1. One way to check is by asking trainees to rate their instructors. An example is the U.S. Navy "Diagnostic Scale for Rating Flight Instructors."

a. Pass sample copies around to the class or copy separate items on the board for demonstration purposes. Various items should be chosen for discussion. (If enough copies are made available have each member of the class fill one out, rating an instructor he had during his training.)

b. Point out that the scale is not for field distribution at this time and that the Navy is only experimenting with its use.

c. Emphasize the fact that it gives the trainee a chance to express his opinions of the instructor.

2. The "Self-Audit for Flight Instructors" is another method of checking on flight instruction practices.

a. Pass our copies of the "Self-Audit" to members of the class.

b. Point out how the "Self-Audit" form is used.

(1) Review the directions on the cover sheet of the "Self-Audit" with the class.

(2) Emphasize that in answering Sections A, B, C, and D the instructor should refer to <u>specific lessons</u>, which he has just completed teaching, and not to his instruction in general.

(3) Emphasize that the "Self-Audit" is entirely for the benefit of the instructor, and is not to be picked up by the operator or inspector. Therefore, an instructor who answers the items incorrectly is fooling nobody but himself.

c. Discuss when to use the "Self-Audit."

(1) It should be used at regular intervals. These intervals should be rather frequent for the first year of instruction. Bring out that the directions suggest that the instructor rate himself on four consecutive lessons, since a single lesson might not be representative.

(2) It should be used whenever the instructor is having trouble with a particular trainee and especially if a number of his trainees seem "weak."

d. Present for class discussion the question: "What good will it do to fill out the 'Self-Audit'?" Bring out the following points:

(1) The "Self-Audit" is in reality a brief review of what they have been taught in this course.

(2) It provides a means by which the instructor can check how closely he is following prescribed training practices.

(3) It provides the beginning instructor with "knowledge of his own progress."

(4) It provides the instructor with an analysis of his specific strengths and weaknesses.

(a) Refer to the story concerning Ben Franklin, who prepared a list of traits he wanted to develop and then checked himself at the end of each day. He improved so much on the 12 traits he had picked out that after a month he had to add a 13th trait -- humility -- to keep from becoming too satisfied with himself.

3. Inviting the trainees to give informal comments on instruction is still another way of checking on teaching habits.

   a. If the instructor is well enough acquainted with his trainees he can ask them (perhaps at the end of the course) what is wrong with his instruction or how he could improve it.

      (1) He will have to impress upon them, however, that he is not going to hold it against them and that he is really interested in improving his teaching practices.

      (2) This method must be used with extreme caution. The instructor should not get mad at what he hears because if he asks for it some of the trainees are going to tell him. He must be able to take and evaluate the trainees' suggestions or criticisms in terms of improving his teaching habits.

   b. Cite the technique of one of the W.T.S. officials (formerly a flight operator) who reports that in his own flight-instructing experience the following procedure was very revealing: At the completion of the course he gave a party for the trainees at which he rigged up a mock airplane. The instructors climbed in the back seat and the trainees were put in the front and told to impersonate their instructor.

      (1) The trainees got a lot off their chests.

      (2) The instructors got a lot of hints for improving their instruction.

V. EVALUATION AND REVIEW

A. Summarize the main points of the lesson.

1. The need for a periodic check-up on instructor practices.

2. The value of the "Self-Audit" as a check-up device.

3. The value of the trainee's opinion of the instructor.

ASSIGN the questions on the evaluation of the course. Point out that instructor-trainees may use any of the materials in preparing their answers. Answers should be handed in at the beginning of the final examination.

SUMMARY OF THE COURSE

Unit Lesson Plan X (First Hour)

I. AIMS OF LESSON

A. To summarize the main topics in the course as they apply to the improvement of flight instruction practices.

B. To discuss the place of the flight instructor in the war effort.

II. MATERIALS

☐ Copy of "25 Opinions on Flight Instruction" for each member of the class.

III. PREPARATION

A. Review the Unit Lesson Plans I through IX and the demonstration materials.

B. Prepare a discussion of the place of the flight instructor in the war effort.

IV. PRESENTATION AND DEMONSTRATION

A. Give the class the list of "25 Opinions on Flight Instruction."

1. Have the class mark their agreement or disagreement with the opinions.

2. Have the class compare the way they marked the list at the beginning of the course with their markings at the end of the course.

3. Determine the items on which the opinions of a number of members of the class changed, and by discussing briefly the points in the course bearing on such changes, introduce the summary of the course, outlined below.

B. Write on the board the following eleven "Points to Remember in Flight Instruction":

1. Treat the trainees' difficulties as <u>learning</u> problems.

2. Deal with each trainee's problems <u>individually</u>.

3. Keep the trainee interested, i.e., motivated.

4. Recognize the importance of the trainees' physical fitness.

5. Maintain the trainees' emotional fitness.

6. Plan ground and air instruction in advance. Remember the steps: Statement of Aim, Preparation, Presentation and Demonstration, Try-out and Practice, and Review and Evaluation.

7. Conduct ground instruction as an organized discussion.

8. Keep instruction in air clear, simple, and concise.

9. Direct the trainees' learning.

10. Use a systematic procedure for evaluating and grading the trainees' performance.

11. Emphasize, in all instruction, the importance of developing Precision, Judgment, and Ability to Plan Ahead.

C. Take up each point briefly, and through class discussion bring out the material in the course bearing on each of the points.

> Following, for the guidance of the methods instructor, is a summary of points that may be emphasized in the discussion. Feel free to add other points.

1. Treat the trainees' difficulties as learning problems.

   a. Point out that the characteristic shape of the learning curve indicates that trainees learn rapidly at first, and that in the later stages the rate of learning gradually decreases.

   b. Point out the importance of recognizing variations in the rate at which trainees learn.

   c. Mention the dangers in trying to teach too much too fast.

   d. Stress the importance of "habit sequences" in the learning of complex maneuvers.

2. Deal with each trainee's problems individually.

   a. Bring out the importance of individual differences in basic ability, background, and desire to fly in determining the rate at which trainees learn.

   b. Point out the dangers in typing trainees.

   c. Stress the value of a "Personal Logbook" in keeping a record of each trainee's problems and progress.

3. Keep the trainee interested, i.e., motivated.

   a. Emphasize the importance of the instructor's developing and maintaining the trainee's desire to learn to fly.

   b. Bring out the necessity of setting goals for the trainee to shoot at during his training, and the importance of making certain that these day-to-day goals are within the trainee's reach.

   c. Bring out the use of praise and reproof, and the knowledge of progress as methods of motivating the trainee.

   d. Stress the importance of the instructor's endeavoring to see the trainee's problems from his point of view.

4. Recognize the importance of the trainees' physical fitness.

   a. Point out that teaching a sick trainee is usually a waste of time and that such cases should be referred to a physician immediately.

   b. Point out that the trainee's fitness is a problem for the instructors as well as for the flight surgeon. Discuss briefly how the instructor should handle:

      (1) the problem of fatigue,

      (2) the problem of airsickness,

      (3) the problem of common colds.

5. Maintain the trainees' emotional fitness.

   a. Emphasize that the instructor should recognize muscular tension in the trainee, try to determine its cause, and relieve it.

   b. Point out that the instructor should recognize the "danger signals" of emotional strain, and endeavor to determine, and to eliminate, the underlying causes.

   c. Emphasize the fact that the trainee should be prepared for all situations to which he might be expected to react emotionally, e.g., first flight, first solo flight, flight test, simulated emergencies, etc.

Make a brief summary of the topics discussed during this hour.

Unit Lesson Plan X (Second Hour)

If there has been an extended lapse of time between the first and second hours of this lesson present a brief summary of the topics discussed during the last hour.

IV. PRESENTATION AND DEMONSTRATION (Continued)

C. (Continued)

6. Plan ground and air instruction in advance.

a. Formulate specifically the aim of each lesson, in terms of requirements of maneuvers, their relationship with other maneuvers, etc.

b. Prepare specific outlines for use in instructing in various maneuvers which should be altered only to meet the needs of specific trainees. Follow the outline: Statement of Aim, Preparation, Presentation and Demonstration, Try-out and Practice, and Review and Evaluation.

c. Give all instruction possible during ground discussions.

7. Conduct ground instruction as an organized discussion.

a. Mention the use of the "Fundamentals of Flight Maneuvers" as an aid in ground instruction.

8. Keep instruction in air clear, simple, and concise.

a. Mention the use of "Patter" as an outline for instruction in the air.

9. Direct the trainees' learning.

a. Contrast directed learning with undirected practice.

b. Bring out the value of the "Flight Inventory" and the "Personal Logbook" in directed learning.

10. Use a systematic procedure for evaluating and grading the trainees' performance.

a. Bring out the use of the "Flight Instructor's Recommendation" form.

b. Show the value of an organized system of observation and notation exemplified by the "Ohio State Flight Inventory."

c. Stress the necessity of an organized and consistent method of assigning grades in the W.T.S. logbook.

11. Emphasize, in all instruction, the importance of developing Precision, Judgment, and Ability to Plan Ahead.

a. Point out that these are absolute requisites for the military flyer.

b. Bring out that all of the teaching techniques discussed in this course can be used in instilling these habits into trainees.

D. Discuss further needs in the improvement of flight instruction. Show the importance of research in such improvement.

1. Point out how studies by the C.A.A. have improved instruction.

a. By organizing the flight courses logically in regard to selection of maneuvers for the various courses, their order of presentation, etc.

b. By the standardization of ground school courses and examinations.

c. By the instituting of standardization centers for C.A.A. inspectors.

2. Point out how research by the Committee on Selection and Training of Aircraft Pilots has been used in this course.

a. The need for the course was indicated by the recording of actual flight instruction in the air.

b. Much of the material on evaluation, prevention of air sickness, meeting the problem of tension, etc., came from such research.

3. Bring out that whenever applicable, the results of research in training methods in industry were incorporated in the present course.

4. Bring out how the class, as instructors in the field, can help in planning future research.

a. Point out that the questions in the "25 Opinions on Flight Instruction" on which there was marked disagreement among members of the class represent areas in which further research should be done.

b. Emphasize that members of your class can aid future research by submitting their problems to the proper W.T.S.

officials, or to the offices of the Committee on Selection and Training of Aircraft Pilots.

5. Point out that the course in instructional methods will continually be revised in light of new research results, and in light of suggestions from instructors in the field.

E. Discuss briefly the contribution of the flight instructor to the war effort.

1. Present the qualifications of the good instructor.

a. He must thoroughly understand his subject matter, and be able to present it in terms the trainee can understand.

b. He must command the confidence and respect of the trainee.

c. He must have as his goal not just pushing his trainees through the course, but getting the most out of every trainee by bringing him up to the highest level of performance possible.

2. Point out that these qualifications demand men who will make flight instruction a profession; and not just a job.

a. Emphasize that the man who is not interested in instruction probably will not meet these qualifications.

b. Point out that viewing flight instruction only as a "job for the duration" detrimentally affects the quality of flight instruction.

3. Remind the group of the responsibility which rests on the shoulders of the flight instructor.

a. Point out that the trainee's basic training in fundamentals of flight performance, and in precision, safety, and planning, greatly influences his later training in advanced and operational courses.

b. Emphasize that efficient training in early courses can sometimes mean the difference between success or failure when the trainee gets into actual combat.

c. Stress the fact that good instructors are contributing more to the successful outcome of the war by training thousands of <u>good</u> pilots than if they were actually in combat themselves.

APPENDIX A

Bibliography and Sources of Reference Materials in the Instructor's Manual.

LIST OF REFERENCE MATERIAL INCLUDED IN INSTRUCTOR'S NOTEBOOK

(The source of the material, or office where copies may be obtained, is indicated following the reference. Where credit is not otherwise given, the material has been prepared by the authors.)

	Unit Lesson Plan
Analysis of eye fixations and patterns of eye movements in landing a Piper Cub J-3 airplane. Tiffen, J. & Bromer, J. Washington, D.C.: C.A.A. Division of Research, Report No. 10, 1943 (abstract).	II
*C.A.A.-N.R.C. Piper Cub Instrument Panel, Photograph of (From Viteles, M.S., Thompson, A.S., & Ewart, E.S. An analysis of photographic records of pilot performance. Washington, D.C.: N.R.C. Committee on Selection and Training of Aircraft Pilots. January 1943.)	VIII
*Card-sorting experiment, procedures for	III
Charts to be used as aids in lesson plans (From Civil Pilot Training Manual. Civil Aeronautics Bulletin #23. Washington, D.C.: U.S. Government Printing Office, 1939. Figs. 41, 43, 45, 46, 49, 50, 51, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 78, 79, 80, 81, 82, 83, 84, 85, 86.)	VII
*Description and analysis of motion photographs of 360° steep turn, Reel 1.	II
*Description of motion photographs of good and bad performance on selected maneuvers from a flight test, Reel 2.	VIII
Diagnostic scale for rating flight instructors. (U.S. Navy, Aviation Psychology Section, Bureau of Medicine and Surgery.)	IX
*Early flight inventory, sample of (From Edgerton, H.A. & Walker, R. Y. Criteria of flight competence. Washington, D.C.: N.R.C. Committee on Selection and Training of Aircraft Pilots. September 1940.)	VIII

* Denotes that the material is on file in, or is available from, the office of the Chairman, Committee on Selection and Training of Aircraft Pilots.

	Unit Lesson Plan
*Flight instruction plan and trainee evaluation, instructor-trainee outlines of	VII
Flight instructor's recommendation, or Pilot flight test report, Form ACA, 342 A. Washington, D. C.: Department of Commerce, Civil Aeronautics Authority War Training Service, 1943.	VIII
Flight instructor's vocabulary, the (From E.E. Kelly, The flight instructor's vocabulary. Washington, D. C.: C.A.A. Division of Research, Report No. 20, August 1943.)	I
*Flight recorder, photograph of (Recorder developed at Massachusetts Institute of Technology, under a grant-in-aid by the Committee on Selection and Training of Aircraft Pilots.)	VIII
*Friez flight analyzer, photograph of (Instrument employed in several studies of the Committee on Selection and Training of Aircraft Pilots.)	VIII
Fundamentals of elementary flight maneuvers. Civil Aeronautics Bulletin No. 32, Washington, D.C.: The U.S. Government Printing Office, 1943. (Adapted from: Fundamentals of basic flight maneuvers for Civilian Pilot Training (Supplementary student material). (1st ed.) Washington, D.C.: C.A.A. Division of Research, 1942.)	I, II, & VII
Fundamentals of secondary flight maneuvers for Civilian Pilot Training (Maneuver sheets). (2nd ed.) Washington, D.C.: C.A.A. Division of Research, 1943. (Draft version, unreleased.)	II
General principles of learning. (From The psychology of learning in relation to flight instruction. Prepared by N.R.C. Committee on Selection and Training of Aircraft Pilots. Washington, D.C.: C.A.A. Division of Research, Report No. 16, June 1943.)	II, III, & V
*"How'm I doin'?" (From an address delivered at the Operations Section of the Pennsylvania Electric Association, Johnstown, Pa., April 24, 1940, by M. S. Viteles.)	IX
*Instructor's personal logbook for each trainee, sample of	VII & VIII

*This material is on file in, or is available from, the office of the chairman, Committee on Selection and Training of Aircraft Pilots.

	Unit Lesson Plan
*"Introductory remarks" by M.S. Viteles at opening session of Institute at Minneapolis, Minnesota.	I
*Introspective reports on learning to pilot an Aeronca Chief plane. (Excerpts from these reports appear in: Viteles, M.S. & Thompson, A.S. The use of standard flight and motion photography in the analysis of aircraft pilot performance. Washington, D.C.: C.A.A. Division of Research, Report No. 15, May 1945.)	II & VI
Job instruction, a manual for shop supervisors and instructors. Washington, D.C.: War Production Board. (For sale by Superintendent of Documents, Washington, D.C.)	IV
*Motion photographs of good and bad performance on selected maneuvers from a flight test, Reel 2, description of	VIII
25 opinions on flight instruction. (From U.S. Navy Opinions on Flight Instruction. Washington, D. C.: U.S. Navy, Aviation Psychology Section, Bureau of Medicine and Surgery.)	I & X
Phonograph records. (See "Transcripts.")	
A preliminary study of certain predictors of success in Civilian Pilot Training. Kelly, E.L. & Ewart, E.S. Washington, D.C.: C.A.A. Division of Research, Report No. 7, December 1942 (abstract).	VIII
*Record sheet for analysis of practice flight observations.	VIII
*Sample student comments. (From an investigation of flight instruction conducted by E. L. Kelly at Purdue University, Lafayette, Indiana, under the auspices of the Committee on Selection and Training of Aircraft Pilots.)	
*Scale for rating pilot competency. (From Kelly, E.L. The development of "A scale for rating pilot competency." Washington, D.C.: C.A.A. Division of Research, Report No. 18, July 1943.)	VIII
*Self-audit for flight instructors.	IX

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* This material is on file in, or is available from, the office of the Chairman, Committee on Selection and Training of Aircraft Pilots.

	Unit Lesson Plan
*Sequence of maneuvers for final check flight, sample diagram of (Prepared in the course of research conducted by M.S. Viteles and A.S. Thompson at the University of Pennsylvania, under the auspices of the Committee on Selection and Training of Aircraft Pilots.)	VIII
*Servis recorder, photograph and description of	II
*Standard check flight procedures. (From Viteles, M.S. & Thompson, A.S. The use of standard flights and motion photography in the analysis of aircraft pilot performance. Washington, D.C.: C.A.A. Division of Research, Report No. 15, May 1943. Also issued as Standard check flight procedures. Washington, D.C.: C.A.A. Division of Research, Bulletin No. 1.)	VI & VIII
Story behind the PATTER, The (From Kelly, E.L. & Ewart, E.S. The effectiveness of "Patter" and of "Fundamentals of Basic Flight Maneuvers" as training aids. Washington, D.C.: C.A.A. Division of Research, Report No. 6, December 1942.)	I & VII
Study of visual depth perception in aviation by C. Pfaffman. Published as a supplement to Tiffin, J. & Bromer, J. Analysis of eye fixations and patterns of eye movements in landing a Piper Cub J-3 airplane. Washington, D. C.: C.A.A. Division of Research, Report No. 10, February 1943.	II
*Suggested questions to be assigned prior to the final examination.	IX
*Suggested questions for final examination.	X
**Transcript of Phonograph Record 1, Selections A and B.	I
**Transcript of Phonograph Record 2, Selection A.	II
**Transcript of Phonograph Record 2, Selection B.	V
**Transcript of Phonograph Record 3, Selection A.	III
**Transcript of Phonograph Record 3, Selection B.	V
**Transcripts of Phonograph Records 4, 5, 6, and 7.	VII

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* This material is on file in, or is available from, the office of the Chairman, Committee on Selection and Training of Aircraft Pilots.

** Transcripts are of phonograph records included in the Instructor's Kit and used for demonstration purposes.

APPENDIX B

Bibliography and Sources of Materials in the Instructor's Kit and of Other Materials Called for in the Course.

CONTENTS OF INSTRUCTOR'S KIT

(Supplementary Material)

	Unit Lesson Plan
How to prevent air sickness. Van de Water, M., in cooperation with Wendt, G. R. Washington, D. C.: Civil Aeronautics Administration Division of Research, October 1942.	VI
*Manual for administration of the "Ohio State Flight Inventory." (1st ed.) Washington, D. C.: Civil Aeronautics Administration Division of Research, March 1943. (Draft version, unreleased.)	
*Materials for card sorting experiment. (Cards and graph paper.)	III
*Motion photographs of 360° steep turns, Reel 1.	II
*Motion photographs of good and bad performances on selected maneuvers from a flight test, Reel 2.	VIII
*Ohio State Flight Inventory. (Reproduced in Manual for administration of the "Ohio State Flight Inventory."	
**Phonograph Record 1, Selections A and B.	I
**Phonograph Record 2, Selection A.	II
**Phonograph Record 2, Selection B.	V
**Phonograph Record 3, Selection A.	III
**Phonograph Record 3, Selection B.	V
**Phonograph Records 4, 5, 6, and 7.	VII

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* Denotes that material is on file in, or can be obtained from, the office of the Chairman, Committee on Selection and Training of Aircraft Pilots.

** Phonograph Records 1, 2, and 3 were taken from recordings of flight instruction made in the course of a research project at Purdue University, directed by E. L. Kelly, under the auspices of the Committee on Selection and Training of Aircraft Pilots. Records 4, 5, 6, and 7 were prepared by the staff appointed by the Chairman, Committee on Selection and Training of Aircraft Pilots.

OTHER MATERIALS CALLED FOR IN THE COURSE

	Unit Lesson Plan
Civil Pilot Training Manual (2nd ed.) (Civil Aeronautics Bulletin #23) Washington, D. C.: United States Government Printing Office, 1941.	VII and VIII
Dummy set-up of rudder and stick controls. (Provided by the ground-school course contractor.)	VII
Fit to Fly Grow, M. & Armstrong, H. G. New York: Appleton Century, 1941, pp. 327-331.	VI
Flight Instructor's Manual (Civil Aeronautics Bulletin #5, first edition, June 1939, third edition, September 1941. Washington, D.C.: United States Government Printing Office, 1941.)	VI, VII and VIII
*Lantern slides of Figs. 45, 46, C.A.B. #23. (1939 edition) (Optional).	VII
Model airplane with movable controls. (Provided by ground-school course contractor.)	VII
*Outline of course of flight training in C.A.B. #5.	VII
Patter for elementary flight maneuvers. (Civil Aeronautics Bulletin #31) Washington, D. C.: United States Government Printing Office, 1943.	I and VII
W.T.S. logbook Form ACA 594 (revised), or Form ACA 1190. Washington, D. C.: The United States Government Printing Office, 1942.	

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* Denotes that the material is on file in, or is available from, the office of the Chairman, Committee on Selection and Training of Aircraft Pilots.

APPENDIX C

Representative Samples of Materials
in the Instructor's Manual.

Materials for Unit Lesson Plan I

INTRODUCTORY REMARKS

by

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

Reprint of opening remarks by the Chairman of the Committee on Selection and Training of Aircraft Pilots delivered before the War Training Service Institute on Training Methods in Minneapolis, Minnesota, April 1943.

INTRODUCTORY REMARKS
by
Morris S. Viteles

This is an interesting experience for me. I am reminded of a trip I took about twenty-five years ago. I was still a young graduate student at the University of Pennsylvania, when I had the good fortune to meet a man who at that time was Dean of the School of Engineering of Drexel Institute, Philadelphia, and who had become involved with the rehabilitation of war veterans. After the last World War there was established a Veteran's Bureau which took hold of disabled men who came back from France and tried to fit new careers for them. He had been working in that, and I had done a little work for him. Shortly after we met, he became Director of Education for The Milwaukee Electric Railway and Light Company, and invited me to come out to Milwaukee to apply some of the psychological techniques that had been worked out for use in the industry to the personnel of the Milwaukee Electric Railway and Light Company.

My first job there was to develop a method for selecting competent streetcar motormen and improving methods of training new men. I started that job by taking an apprenticeship as a motorman. That was the beginning of many years of experience with these problems of training industrial personnel.

I am reminded that, as I took that course, I was amazed at some of the things that were happening. The way they ran that course was to take an apprentice, send him down to one of the old barns where they had fitted up an old trolley car with trolley equipment so that he could learn something about the equipment, show the apprentice where the brakes and other controls were, and then send the man out on a car with an experienced motorman. These motormen were especially selected. Each motorman who was selected got two cents an hour extra when he had a student working with him in the car. That was his reward, sixteen cents a day for training these students.

I remember the first man with whom I went received me in somewhat this fashion: He said, "Huh, another one of youse guys! I have to worry all day because you might be running this car and have an accident, and maybe I'll get fired because you had an accident." That was actually my reception on the car.

Well, we started off. What happened was I stood alongside of him for a while, and he showed me how he handled the controls, how he handled the brakes, and how he handled the little lever that opened the door, and I watched him for three or four hours. Then we came to a quiet time of the day and a quiet stretch of the road, and he said, "Now, you try it," and I tried it. I tried it for a period of about two hours with this man hovering over my shoulders. I could just see that he was ready to grab that control handle any time I did

something that looked wrong, and he bawled me out for approximately the whole two hours because I wasn't doing the job right. He wanted it done a certain way, and I didn't do it that way during those two hours. Then the busy period came up and he took over the car, and that was the end of my instruction for that day.

The next day I reported at five in the morning and was sent out with another motorman on another streetcar, and we followed approximately the same procedure. I had approximately the same pleasant welcome greeting that I had received from the first man. I stood looking at him for about three or four hours, and finally was given the car to handle. I took the controller and started notching it up to make it start, and immediately he threw up his hands and said, "That isn't the way you handle the controller. You are moving it too slowly. You don't want to move it 1, 2, 3, 4, 5, 6; what you want to do is to move it 1, 2, 3, 4, wait a fraction of a second, 5, 6, 7, 8." There were eight notches in that controller as I remember. Then we came to a corner and I started to brake the car.

The first motorman had told me to take a long bite of air by moving the lever slowly over to the right, then to bring it back to neutral position and just hold it. I did that very carefully. But the second motorman said, "That isn't the way to stop the car. You will just jerk the passengers out of their seats." In those days they were a little worried about jerking the passengers out of their seats, but they have changed a lot since. "Now, what you want to do is to take two short bites of air then release a little bit, and your car will come to a nice, smooth stop." So throughout that day I practiced very carefully 1, 2, 3, 4, stop, 5, 6, 7, 8, stop, and when we came to the corner bite, bite, release. This I did pretty well by the end of the day.

The third day came along, and I was sent out with another motorman, and that motorman, I assure you, had ideas on how to run a car that were entirely different from those of the first two men. This continued for a period of fourteen days, because a man spent fourteen days in learning how to operate one of these streetcars, and he spent it with fourteen different men, the notion being that simultaneously he would learn how to run the car and learn the different routes of the city so that he could be assigned to any one of these routes. But every one of these motormen had a little trick, some individual peculiarity in operating that car, and every day the apprentice unlearned what he had learned the day before and started on an entirely new method of operation.

Well, that's the way men were being trained twenty-five years ago in industry. The Milwaukee Electric Railway and Light Company wasn't any different from other companies; they were all doing it the same way. There was no system, no organization, and no attempt had been made, for example, in the transportation industry, to find out the best method of operation, the best method of picking up speed quickly and the best way of stopping the car so that the passengers wouldn't be jerked out of their seats. You may be interested

to know that as a result of that analysis the industry made an investigation, and arrived at a standard method of operating a streetcar which is more or less uniform throughout the country.

At the same time transportation companies and other industrial concerns found that teaching a man how to do a job involved more than merely presenting the correct method of work. In analyzing the situation they discovered that there are good ways of teaching and poor ways of teaching. As a result, during the past twenty-five years the transportation and other industries have designed improved training programs to teach their good supervisors how to teach other men. They have found men who are darn good supervisors, who could handle men, to whom they gave the responsibility for teaching men, but who couldn't do a good job largely because they weren't acquainted with some of these "tricks" with respect to teaching that have been worked out as the result of research in the field of education and in industry.

To show how marked these developments have been I need only refer to the Training Within Industry program of the War Manpower Commission. Have any of you heard about this? Well, when we went into this war there was set up very quickly, in what was formerly the War Production Board and what is now the War Manpower Commission, a job-training-in-industry program through which courses in job-training methods are being given to hundreds of thousands of supervisors throughout the country. They are going into industrial plants and giving the supervisors a short, intensive training course on teaching methods, because they know that many men who are good supervisors have not had the opportunity to get acquainted with these better teaching techniques that have been applied very widely in the more progressive industrial plants in this country.

In a sense, that is what we are attempting to do in this course. We are recognizing that throughout the country there are a lot of men engaged in instructing pilots. They, themselves, every one of those men, are good pilots. Each has learned, and very frequently he has learned the hard way. A large proportion of them, I am convinced, have a very sincere and honest interest in teaching other pilots in the best possible way, but many of them are handicapped by the fact that in spite of their interest in teaching pilots--and it is their desire to do a bang-up job--nobody has taken the trouble to tell them a little something about teaching methods, and to bring them in touch with the latest developments with respect to training pilots that have grown out of some of the research that has been done by our committee and by other groups.

Now, I think that you fellows are taking upon yourselves a tremendous responsibility. I think, in a sense, you might be appalled by what is happening in this room today. Here you are, a group of seven men, who may very well revolutionize some of the methods that are being used in training pilots today. If the material that we give you, if the ideas that we discuss with

you during this ten-day course do any good, you will revolutionize to some extent the program of pilot instruction in this country.

Now, we think this course is good, but we are biased. Moreover, some of us haven't had that direct experience in training pilots which you men have had. What we hope you are going to do, in addition to learning something about the better methods of instruction as we understand them, is to tell us how to improve on some of the ideas that we give you, so that we can revise this instruction material and put into it the benefit of your long years of experience in instructing men. If we don't come out of this course with some changes in these ideas that we put down on paper as the result of these discussions here, I think we shall have lost a tremendous lot.

You men have had direct experience in training pilots. You can improve this course by adding your ideas to those we are able to present as a result of combining what we ourselves have done in research with our knowledge of what has been done in industry in the way of improving training methods. Actually, what we are giving you really represents a combination of those two items—the outcomes of our own research and our knowledge of what industry has done to improve training methods.

Now, just a word about our research. Research is a terrible word to use. It sounds academic and it sounds impractical, and it sounds just theoretical. A good deal of research <u>is</u> impractical, and a good deal <u>is</u> theoretical. Some of the research that we have done has been impractical. On the other hand, as a result of three years of work we have discovered many things about training methods that seem to be highly practical, so practical, at least in the case of the "Patter" book, that the Navy immediately printed 20,000 copies and sent out an official directive saying, "This is the way you are going to teach your pilots." Now, if a hard-headed, practical Navy man with years of experience in training says, "This thing looks workable," we can certainly agree that this part of the research must have some practical value.

Our research program has been going on for three years. It was started by the C.A.A. in 1939. In 1939 the C.A.A. came to the National Research Council and said, "We are starting an intensive program for training civilian pilots. It is going to be countrywide, and we are going to have this done by individual operators. We are not going to set up a bureau with a lot of instructors; we are going to go to the private operator and give him a chance to build up his business by instructing young pilots who may be in the market to purchase planes and thereby develop the aviation industry."

That is the way the thing started. The C.A.A., through the Director of Research, Dr. Dean R. Brimhall, came to the Council and said, "We are going into this field. We realize that the personnel problem in aviation is acute. We want to learn what makes a good pilot; second, what can be done to improve the methods used in training pilots." That National Research Council, which is a non-profit organization that simply assembles people who have had experience in this field to work on a problem, got together a committee. The Committee gathered together workers from various universities and various research

centers and started on the program of research in the selection and training of aircraft pilots. I am not going to tell you very much about the research program because, as you go through the course, you will see for yourselves what has come out of it in the way of useful material. However, what has come out of it can have no value unless men like you take hold of it and apply it in the manner which is going to be suggested in this course in training other pilots.

I talked to the captain and executive officer of a battleship the other day. This battleship is used almost exclusively for training purposes, and both of these men said exactly what every other man in a noncombatant position has said--"If we could only get into action; if we could only get out there." "Look here," I said, "you are training x-hundred men a week on this ship, and these x-hundred men, both officers and enlisted men, go out and train x-hundred other men. What are you doing? You are multiplying yourself a thousand fold because of the work that you are doing on this ship. You are doing the job of thousands of men--because every time you train a good man you contribute something to the performance of the fleet in action, you have done something that is important in the combat situation by doing a good teaching job."

Now, what I said to the captain of this battleship and his executive officer applies, I think, to this group. You are men who are going to multiply yourselves a thousand fold if in your training job you take hold of what is good in this course and then go out and put into operation the useful ideas presented to you. You are going to help turn out the highly qualified and efficient pilots that our country needs in its War effort. No greater responsibility has any man.

25 OPINIONS ON FLIGHT INSTRUCTION

Flight instructors do not always agree on the best methods of instruction. The 25 statements which follow represent the sort of points on which they disagree.*

Even though you have not yet done any instructing yourself, you probably have definite opinions on many of these items.

We are interested in knowing how you feel on these points as you begin your training for flight instruction.

You will feel more strongly about some of your answers than you will about others. On some of the statements you may be completely undecided. Place a number in each box to show your opinion. Use the following scale:

1 = strongly disagree!
2 = disagree
3 = undecided
4 = agree
5 = strongly agree!

Be sure to mark every item.

You are to keep this sheet until the final meeting of the class.

1. ☐ Two-way communication between instructor and trainee is not as desirable as one-way communication.

2. ☐ Simply telling a trainee to forget about it will generally remove mild fears.

3. ☐ A good way to handle the over-confident or show-off trainee is to bawl him out in the presence of other trainees.

4. ☐ An instructor should insist that all of his trainees become "experts."

5. ☐ A good way to handle a trainee who is doing poorly is to threaten him with the possibility of washing out.

6. ☐ Elementary trainees should be taught to "fly by the seats of their pants."

7. ☐ The method of instruction and not the trainee is usually the cause of trainee failure.

(over)

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*These statements were selected and adapted from a longer list of opinions prepared by the U. S. Navy, entitled "U. S. Navy Opinions on Flight Instruction." The scale was designed to measure the opinions of experienced flight instructors.

8. ☐ Check flights should be given only for the assignment of log-book marks.

9. ☐ Trainees who learn slowly become the most proficient pilots in the end.

10. ☐ Most instruction in the air is not properly organized.

11. ☐ Criticizing the trainee for his mistakes is a more effective teaching method than praising him for good aspects of his performance.

12. ☐ A considerable portion of flight instruction time can be spent more profitably on the ground than in the air.

13. ☐ The primary prerequisite of a good flight instructor is the ability to fly well.

14. ☐ Pilots are born — not made.

15. ☐ It is a desirable practice to have occasional check flights between instructors.

16. ☐ All students who need more than 10 hours to solo should be washed out.

17. ☐ Instructors have little need to consider the effect of their personality and appearance on their trainees.

18. ☐ Setting too fast a pace may be the real reason some trainees wash out.

19. ☐ Most instructors forget that they are not literally "in the trainee's shoes" during flight instruction.

20. ☐ Keeping a "personal log-book" on each student is not worth the extra work it involves on the part of the instructor.

21. ☐ If a student gets air sick in the plane, the instructor should be made to clean it up.

22. ☐ Without a well-organized lesson plan the most skillful pilot with perfect "Patter" may still be a poor instructor.

23. ☐ Instilling pride in equipment by giving the trainee responsibility for line checks is a good way to instill pride in his flying performance.

24. ☐ Except in a dangerous situation the instructor should allow the trainee to make a few mistakes, rather than taking over immediately.

25. ☐ Instructors should make minor control adjustments without telling the trainee he is being helped.

TRANSCRIPTS OF DEMONSTRATION RECORDS*

Record 1, Selection A: Poor Instruction

Instructor: Now let's get into a normal glide; that's been one of your troubles....Don't pull the stick backwards and forwards, backwards and forwards — just get your approximate speed — and check it occasionally with your air speed indicator....Don't sit with your head in the cockpit and try and hit 65 knots on the nose; it won't work. Keep your speed — now, all right, let's see you break that glide — smoothly — do you have to do everything — like you were driving a truck? Come back easy — easy — all right, hold it, let's go — all right — I've got it.

Record 1, Selection B: Fair Instruction

Instructor: Now on that last approach, that wasn't a very good approach, you should have gone on farther to the north, held your altitude, closed your throttle, and made a turn — you'll see that the last thousand feet in toward the airport must be in a straight line.

Student: I didn't make a big enough circle.

Student: Now do you ever make a 45 degree turn or do you always go up and make a 90?

Instructor: Well, some turns will be 45. You should make a 45 right after — on the first turn.

Student: Oh, I see.

Instructor: However, we always make 90's here, go around here so we have square corners.

Student: You come right around like this.

Instructor: That's right, now right around in a nice 90 degree turn — Now hold your bank constant and your nose right where it is —

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*From a research project conducted at Purdue University, Lafayette, Indiana, under the direction of E. L. Kelly, under a grant-in-aid by the National Research Council Committee on Selection and Training of Aircraft Pilots, from funds provided by the Civil Aeronautics Administration.

now recover — hold your nose up there — that's the time.... You see that makes a much smoother turn, and it's even easier to do.

Student: You have to crab quite a good deal in order to keep her —

Instructor: That's right — now does that nose want to drop down?

Student: Yes it does a little bit.

Instructor: Well, we'll crank that stabilizer back a little — how's that?

Student: That's better.

Instructor: It seems to be working for a change. They tightened it up but I still noticed that it don't work good....Now I'll show you what I mean by that approach.

Student: You've got it, huh?

Instructor: No, I'm just showing you where to cut your throttle — Now we'll close it right here — now glide on straight for just a few feet here — now let's make another turn — 45 degrees this time see.... Now you would have been down lower if that air hadn't hit you.... Well, let's not let that bother us....Just hold a normal glide now — see what happens — you're settling faster now than when you went up there — did you notice that?

Student: Yes, we're going right into the wind....Now see if I can put this thing down....I'm landing too damn high in the air, I'm afraid.... (Landing).....Did I do that?

Instructor: You did that. You also did something wrong.

Student: What was that?

Instructor: You notice after you got down she kept right on going around? I want to show you what would happen. Supposing that thunder shower would break right now a little ahead of schedule.... We'd get the gusty air which usually accompanies it....Here we are in this position. You were landing that way. Now I touched a little rudder to bring you around this way....Well, you see what would happen if the wind got under that wing.

Student: Yeah.

Instructor: It would be pretty bad.

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TRANSCRIPT OF DEMONSTRATION RECORD*

Record 2, Selection A: Ground Instruction

Instructor: Today I want to give you some eights around pylons. On these pylons, you pick out two pylons such as fence corners, hay stacks, or trees, crosswind, about twelve hundred to fifteen hundred feet apart. Say right here would be one pylons and here would be the other one, and the wind is coming from this direction — out of the north -- you fly down along your pylons a little on the down wind side...and as you come to the pylon right here, why you start your turn into the wind...trying to keep your airplane equidistant from your pylon all the way around...making a pattern of a figure eight on the ground course. Now since the wind is from this direction, we'll say this is a pylon right here...as you come down here, into the wind ---

Student: Yeah.

Instructor: -- your bank wants to be kind of shallow. As you come into the wind — as your ground speed decreases why decrease your bank, and as it increases why increase your bank. As we start around here why you start increasing your bank a little bit, and right along here is your steepest bank of course. After you get over here on this side, why forget that pylon and watch for the next one — concentrate on it and allow for your wind drift. Fly straight and level between your two pylons. We'll go out here and pick a couple or three pylons and — I'll do a few for you.

Student: The wind is coming from this direction, isn't it?

Instructor: Yeah.

Student: You start out here...did you say that? Let's see...I must have got that wrong.

Instructor: See...the wind is out of this direction.

Student: You start with a shallow bank?

Instructor: Well as you come -- yeah at first you start with a fairly shallow bank.....

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*From a research project conducted at Purdue University, Lafayette, Indiana, under the direction of E. L. Kelly, under a grant-in-aid by the National Research Council Committee on Selection and Training of Aircraft Pilots, from funds provided by the Civil Aeronautics Administration.

April 1, 1943

ANALYSIS OF EYE FIXATIONS AND PATTERNS OF EYE MOVEMENT IN LANDING A PIPER CUB J-3 AIRPLANE

Motion pictures of the eye-movement patterns of pilots during the last 5-10 seconds before landing were analyzed to determine whether certain of them were characteristic of the skillful pilot.

Photographs were taken of the pilot's eyes at the rate of 16 frames per second with a camera specially mounted in a Piper Cub J-3. Three flashlight bulbs on the pilot's headgear were activated in turn by a device which measured the distance from the ground and indicated the exact time at which the wheels first touched.

The pictures were studied first in normal projection and later by a detailed frame-by-frame analysis. Graphs of the eye movements of 33 pilots were made for a total of 177 landings. These graphs show the movements in 7 different visual fields as determined by the windows of the plane. The graphs are separated into four groups according to the flight experience of the pilot.

Analysis of the data reveals that the experienced pilots exhibit no single general pattern of eye movement. On the other hand, individual pilots show a certain amount of consistency in their own patterns of movements while landing. Another tendency revealed by the graphs is the tendency of many pilots to spend a certain portion of the last five seconds in looking directly toward the front of the ship.

It is concluded that there are no clear-cut differences between the eye-movement patterns of the experienced and inexperienced pilots. Experienced pilots, however, show back-and-forth excursions until the last five seconds before landing. Inexperienced men do not all show these. Some of the experienced pilots continue excursive movements during the last five seconds before landing, while other experienced pilots tend to settle down to one area, looking to the right or left, but not alternately between right and left. The settling occurs either in the forward area, representing 12° of vision, or in the adjoining large area representing 54°. Either one of these two areas on either side of the plane seems about equally likely to serve the pilot's visual purposes. Settled fixation just before landing seems to occur at right angles to the axis of the ship.

Abstracted from Analysis of Eye Fixations and Patterns of Eye Movement in landing a Piper Cub J-3 Airplane, by Tiffin, J. and Bromer, J. Report No. 10 to Division of Research, Civil Aeronautics Administration.

PROCEDURES FOR THE CARD SORTING EXPERIMENT

I. AIM OF THE EXPERIMENT

To demonstrate general characteristics of learning.

II. MATERIALS

A. Pack of 80 cards, 10 each of cards numbered one to eight, respectively. (These cards have been taken from a Flinch deck.)

B. Watch or timer.

C. Graph paper for drawing learning curves.

III. PROCEDURE

A. Members of the class will work in pairs; one acting as subject (S) and the other as experimenter (E).

B. One card of each number (1 to 8) will be placed on the table before the subject in two rows arranged as follows:

Arrangement A:

1st Row 3 - 8 - 1 - 6

2nd Row 5 - 2 - 7 - 4

C. Instructions to subject.

> "Hold the pack of cards face up in your left hand (for right-handed subjects). When I give the signal, sort them on to the proper piles. Correct any errors of sorting immediately. Stand while sorting. Your score will be the total time necessary to sort the cards in the pack. Work as rapidly as possible. Ready -- begin!"

D. Fifteen trials will be made with arrangement A. When picking up the cards at the end of each trial, leave the bottom card of each pile on the table as a guide for the sorting of the next trial.

E. Five trials are then made with the piles rearranged according to arrangement B as follows:

Arrangement B:

1st Row 4 - 2 - 5 - 8

2nd Row 1 - 7 - 6 - 3

F. Five additional trials are then made with the piles in the original arrangement, i.e., arrangement A.

G. Precautions.

1. The 25 trials required in the experiment should be made in succession with only enough time elapsing between trials to prepare for the next trial.

2. The time is recorded in seconds.

3. Errors of sorting must be pointed out by E and corrected immediately by S.

4. The S should be urged to work as rapidly as possible throughout the experiment.

5. The cards must be thoroughly shuffled for each trial. When picking up the cards at the end of each trial, take up a few from each pile in a haphazard way rather than the whole pile.

IV. RESULTS

A. Each subject will have 25 scores in terms of total time in seconds for each of the 25 trials, the first 15 for arrangement A, the next 5 for arrangement B, and the last 5 for arrangement A.

B. Each subject will pilot his scores on graph paper with time in seconds on the vertical axis and successive trials on the horizontal axis.

TABLE OF RESULTS

ARRANGEMENT A		ARRANGEMENT B	
Trials	Time	Trials	Time
1		16	
2		17	
3		18	
4		19	
5		20	
6			
7		ARRANGEMENT A	
8		21	
9		22	
10		23	
11		24	
12		25	
13			
14			
15			

TRANSCRIPTS OF DEMONSTRATION RECORDS*

Record 3, Selection A: Teaching too much too fast.

Instructor: Now on these eights around, see, you fly between your pylons downwind, start your turn, and keep the same distance from your pylon during the turn. You'll have to shallow out when you head into the wind, and steepen the bank when you are headed downwind. That is you bank rather steeply when you enter the turn, shallow it out gradually as you turn into the wind and then when you begin turning downwind you steepen the bank up. Then when you finish with one pylon forget about it and concentrate on the next one, and follow the same pattern, keeping your distance--keeping the same distance from your pylon all the way around. Get it?

Student: No--I don't--I don't follow you.

Instructor: Never mind--I'll show you one.

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*From a research project conducted at Purdue University, Lafayette, Indiana, under the direction of E. L. Kelly, under a grant-in-aid by the National Research Council Committee on Selection and Training of Aircraft Pilots, from funds provided by the Civil Aeronautics Administration.

TRANSCRIPT OF DEMONSTRATION RECORD*

Record 2, Selection B: Example of poor motivational technique.

Instructor: Now look, you undershot the last time didn't you... well what are you doing way out here this time, huh?

Student: Well I...

Instructor: Oh well, wake up, will you?

Student: (under his breath) Oh for...

Instructor: You'll never make it, you know that...Well why go out here? That's what I'm yelling about...if you undershoot one time, the next time you come around here you better get in there close enough...you make the same old mistakes over and over and over again... You're not getting anywhere at all..See?

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TRANSCRIPTS OF DEMONSTRATION RECORDS*

Record 3, Selection B: Bad instruction on 180° Approaches.

Instructor: Now remember on these precision landings, it's always your height and distance from the field--it's always your height and distance as where you want to land. So I would like to have you bring it around to the same place and whenever you think you are within gliding distance to the field, I want you to cut the motor, make your turn and go in and land.

Student: Cut the motor here.

Instructor: That's right. Now we hope to land somewhere near our spot. You want to watch your height and distance. If you turn in too quick you see you'll be too high, and you won't even get into the field .....No you're still too high.....

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*From a research project conducted at Purdue University, Lafayette, Indiana, under the direction of E.L. Kelly, under a grant-in-aid by the National Research Council Committee on Selection and Training of Aircraft Pilots, from funds provided by the Civil Aeronautics Administration.

TRANSCRIPTS OF DEMONSTRATION RECORDS

Record 4: Excerpt from good Air Instruction.

Instructor: Do you see that paved road ahead of us there, running north and south?

Student: Oh, yes.

Instructor: We'll use it for our landmark, fly parallel to it, enter our turn, turn through 180°, and we'll recover flying parallel to it but headed in the opposite direction. All the time we hold our altitude constant.

Now be certain to notice those reference points we talked about on the ground, check your degree of bank, check whether or not you're flying level. You can follow me through on the controls. Rest your hand--your right hand, lightly on the stick and your left hand on the throttle as I told you yesterday, and rest the balls of your feet on the rudder pedals with your heels on the floor. You'll probably be surprised at the slight control movements you can detect, but as I told you, always think of control application as exerting pressures, not as actual movements.

O.K., we're flying parallel to the road--we'll check our traffic. Look to the left and behind us, since we're going to turn left. Do you see any other planes?

Student: It's all clear.

Instructor: All right, we begin the turn--coordinated aileron and rudder pressure to the left--hold it--there's our bank--aileron and rudder pressure off--back pressure and a little opposite aileron--now get those reference points------now just before we turn parallel to the road we start our recovery--right aileron right rudder--ease off the back pressure--and here we are flying parallel to the road again, straight and level, and headed south.

Did you follow that?

Student: Yes--I think I got it all right.

Instructor: O.K. then, I'll demonstrate one to the right--the procedure is just the same, except that you bank to the right, that is you apply control pressures to the right in entry, to the left in your recovery...I won't talk through this one, you just follow through on the controls. Look for your reference points now... O.K., we check our traffic, and begin the entry. Here we go.....

Now we recover flying north, parallel to the road again. All right, I'll let you have the controls. Make a medium banked turn to the left, through 180°. Enter and recover parallel to that highway. Let's check for traffic...O.K...all yours...now begin your recovery. That's right.

Student: How was that?

Instructor: That was all right. You held your control pressures well, and released them smoothly. You didn't use quite enough rudder on your recovery and as a result you skidded slightly, and you didn't start your recovery quite soon enough. We discussed why you do that before the flight, remember? You have to watch the road during the turn, and start your recovery slightly before you turn parallel to the road again. But I know that's hard to do the first time. So all in all that was a good performance. Now let's try another to the left and see if you can't make it even better...That's the boy..check your traffic.....

Student: How was that? I recovered right on the nose.

Instructor: That was much better, you recovered a little nose-high, but it takes time to catch on just when to ease off the back pressure. O.K., now let's make a turn to the right.

TRANSCRIPTS OF DEMONSTRATION RECORDS

Records 5 and 6: Section of good ground instruction.

Instructor: Now about these Medium Turns. Turns are one of the fundamental maneuvers, along with climbs, and glides, and straight and level flight. Nearly all maneuvers are merely combinations of these basic maneuvers.

Turns now are important not only because they help to get you where you want to go, but also because they give you practice in coordination of your controls which is necessary for precision flying.

Did you read the sheets from the "Fundamentals" I gave you yesterday?

Student: Yes I did, Sir.

Instructor: What is the degree of bank for a medium turn?

Student: About 45 degrees, isn't it?

Instructor: Well, the book says between 30 and 50. With these light planes we fly it will be closer to 30, just about 30 degrees in fact. If you were flying along straight and level, and wanted to turn to the right, what would you do?

Student: Well, I'd give it right rudder and aileron — I mean I'd apply coordinated right rudder and aileron pressure until I got the bank, then neutralize the controls and hold a little opposite aileron to keep the bank from getting steeper. Then to recover I'd use left rudder and left aileron.

Instructor: You'd turn all right, but you'd sure lose altitude.

Student: Oh yes — I'd also use enough back pressure to hold the nose on the horizon.

Instructor: Well, I want to point out here that when you bank, you apply rudder and aileron pressure and <u>hold</u> them until you've reached your bank. You don't keep increasing the pressures during the bank.

Now, why do you hold opposite aileron in a turn?

Student: Well, let's see, it's because if you don't the bank gets steeper since the wing on the outside of the turn has more lift.

Instructor: That's right — it's shown in this diagram here. Since the wing on the outside of the turn — this one — has farther to go in the same length of time it obviously has to go faster, and the increased speed gives it more lift. Now why do you hold back pressure during the turn?

Student: To keep the nose from dropping -- to keep from losing altitude.

Instructor: That's right -- there's an aerodynamic reason for that, but we won't worry about it just now.

Student: Do you apply the back pressure as soon as you begin to bank?

Instructor: Well, the steeper the bank the more back pressure is necessary. For extremely shallow banks you need hardly any back pressure at all. So you delay the application of back pressure slightly on the entry to your turn, and apply it gradually as the bank increases. Keep it -- hold it during the turn. Then during the recovery you release it gradually -- you'll find that it should be completely released just before you complete the recovery. No I don't want you counting one -- two, and then apply back pressure -- that would be mechanical. Just apply it when you need it to keep the nose from dropping. Now what makes the plane turn?

Student: Well.... What do you mean, "what makes the plane turn?"

Instructor: Well, the point I'm making is that you turn by banking, that is the rate of turn is determined by your degree of bank. You can make turns with your rudder alone, of course, but that's poor flying, and it's extremely dangerous. They cause the plane to skid -- remember in the "Fundamentals," that example about the car turning on a flat highway?

Student: Yeah.

Instructor: Well, you need rudder pressure to correct for certain forces in the entry and recovery from a bank. These forces cause the rate of turn to be out of line with the degree of bank. So remember that you turn by banking, and the rudder is sort of a correcting device which you coordinate with the aileron pressure.

Student: I'd never thought of it like that.

Instructor: That's explained in Bulletin 23. So go over that again before tomorrow. How can you tell if you slip or skid?

Student: Look at the ball bank, I suppose.

Instructor: What if you don't have a ball bank?

Student: Well, let's see. If the plane skidded -- I'd -- have a tendency to slide in the seat toward the -- high side --

Instructor: Toward the outside of the turn.

Student: Yah, that's right, and in a slip I'd slide toward the inside of the turn.

Instructor: That's right, and in a good turn you'll feel as if you were being pushed down in the seat. But remember you can only feel those slips and skids if you are relaxed and riding with the plane. You can't feel them if you lean away from the bank and attempt to keep your body perpendicular to the horizon. It's a good idea to check your turns occasionally with the ball bank, it can detect slips and skids that you can't, but don't depend on it too much — some day you may be without one.

Now there was one extremely important point you forgot to mention when you were telling me how to make a turn. What do you always do before you turn?

Student: I know the answer to that one — I check the traffic.

Instructor: That's correct — but don't take that checking traffic too lightly — I can't emphasize its importance <u>too</u> much. You really want to <u>look</u> — turn your head — crane your neck — and look particularly in the direction you are planning to turn. Look straight enough back so that you can see the tail surfaces of the plane....

Student: I'll remember that.

Instructor: All right, now about these medium turns we're going to take up today. Our degree of bank will be about 30 degrees. When we go up I'll demonstrate one or two for you. While I'm demonstrating — that is while the plane's banked — I want you to note the relationship of the wingtip, or some other reference point which you can pick out — notice the relationship of that point on the wing — with the horizon. Remember that relationship so you'll have a guide to tell you when you have proper degree of bank.

Student: How can I tell if the nose is level during the turn?

Instructor: Well, I'm coming to that. You won't be able to use the same reference points you pick for straight and level flight. You'll have to pick up some other ones, perhaps one of the cylinders. Remember that during the turn, you keep looking around from one reference point to the other. Don't just stare at one of them. Now, today, we're going to make these medium turns through 180 degrees.

Student: Let's see — if I turn through 180 degrees I end up going just opposite to the way I started, don't I?

Instructor: That's right — you want to get used to thinking of turns in terms of degrees. We'll use a road as a landmark, fly parallel to it and begin the turn, then recover flying the opposite direction, but again parallel to the road. You'll notice that the recovery will have to be started a little before the plane is parallel to the road again, since the plane will continue to turn during the recovery. That is, you'll have to anticipate your recovery.

Now, making the correct bank, maintaining your altitude, and entering and recovering exactly parallel to the road — all this is known as precision. The emphasis all through this course will be on precision flying. If you were flying in formation and didn't make precision turns, either you or some other fellow, or both of you might lose a wing. That's not good.

Student: I see the point.

Instructor: O.K. Any other questions?

Student: Not now.

Instructor: You seem to have read enough of the assignments to have a pretty good idea of what is going on. I like that. That's very good. Now once more — in these turns remember to check carefully for traffic before you turn. O.K. Let's go.

TRANSCRIPTS OF DEMONSTRATION RECORDS

Record 7: Excerpt of post-flight ground instruction.

Instructor: ...No, you did right well. Have you got any more questions?

Student: Well, yes, one or two. A couple of times you told me that I skidded on the recoveries, and then once I slipped on the entry. I couldn't feel that in the seat of my pants or anywhere else.

Instructor: Well, you could see it in the ball bank indicator, couldn't you? Now as for feeling them. There are probably a couple of reasons why you didn't. One, they weren't particularly violent slips and skids, and again seat sense is something you have to develop. You just haven't felt enough slips to know what they feel like. I'll tell you what we'll do — tomorrow when we go up I'll make some intentional slips and some intentional skids, make them pretty violent ones, and we'll give you an idea of just how they feel. Maybe another reason is that when you're just beginning you are often so busy making the turn, watching your reference points and your landmarks, that you just don't pay attention to your seat sense. Anything else?

Student: I had something else but I can't think of it right now. I'll bring it up later.

Instructor: Well, there are just a few points I want to mention. Let's see — as I told you when we were flying, your application of control pressures was good, you applied the pressures, held them, then released them. But did you notice that on your right turns, the bank tended to shallow out?

Student: Yeah, I did notice that but I don't know why.

Instructor: That's because the torque of the propellor — remember I explained that yesterday — tends to turn the plane to the left. On right turns you don't need to hold quite so much opposite aileron, but you do need a little more rudder on the entry. Those are pretty fine points though, and you catch on to them after a while. You needn't worry about them right now.

You held your altitude well in those turns; I was really surprised. What did you use for reference points?

Student: I tried to keep that second cylinder from the top just about on the horizon — I thought I wobbled once or twice though.

Instructor: Well yeah, you had some variation in altitude, but not as much as most trainees do at your stage of the game. But remember I told you that you skidded on some of your recoveries. Do you know why?

Student: No, I don't know just off-hand.

Instructor: You want to use a little more rudder pressure when you recover. We'll work on that tomorrow -- I'll let you play around and find out exactly how much rudder you can use without causing the plane to slip on the recovery.

Just one more thing..While you were flying straight and level I noticed that you tended to correct for bumpy air by pretty violent applications of the controls. You don't need to do that. If the plane hits a bump it will return to level flight even if you don't make any corrective movements at all. Of course you can speed up the recovery -- that is -- you can bring it back to level flight quicker but you only help it do what it wants to do anyway. So when you correct for rough air, just use gentle co-ordinated pressures instead of those rough sudden movements.

Now tomorrow we'll take up some elementary coordination exercises, -- here are the maneuver sheets from the "Fundamentals." Go over them carefully before tomorrow. We'll also review straight and level, and these medium turns, so look over the maneuver sheets for turns again, and also read the reference in Bulletin 23. I'll have some questions to ask about that material. Now what else was bothering you?

FLIGHT INSTRUCTION PLAN AND TRAINEE EVALUATION

An abstract for instructor-trainees of topics presented in Unit Lesson Plans VII and VIII of the Training Methods Unit of the Controlled Secondary Instructor Course of the War Training Service.

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FLIGHT INSTRUCTION PLAN AND TRAINEE EVALUATION

A. Experience in job training in industry has shown that the best results are obtained when the instruction procedures are organized in advance, according to a carefully worked-out plan. The principal steps in teaching a new task are:

1. Statement of aims or formulation of what is to be taught in a specific lesson.

2. Preparation -- of what to say or demonstrate, and how to do it, including the collection of all necessary materials and training aids.

3. Presentation and demonstration to trainee.

4. Try-out and practice by trainee.

5. Evaluation and review — to determine how well the task is learned and to review it as a whole.

B. Flight instruction is most efficient when it follows these same steps. Good instructors, whether they know it or not, almost invariably go through these five steps. They are nothing new or revolutionary.

C. These five "steps in teaching" apply to ground instruction as well as to instruction in the air. In flight instruction these steps should be followed as outlined below:

1. Statements of aims. The instructor who remarks at the beginning of the flight lesson, "Well, what did we take up yesterday?" indicates that he has not formulated the aim of the lesson in his own mind and is approaching the lesson without preparation. The aims of the lesson must be clear to the instructor before they can be clear to the trainee.

   a. The formulation of what is to be taught includes not only a statement of the maneuvers to be taken up, but also a description of the manner in which they develop from maneuvers previously instructed and an indication of ways in which they are basic to more difficult maneuvers which are to follow.

   b. Determination of what should be taken up should be in terms of the progress of individual trainees. This decision should be made at the end of the preceding lesson so that appropriate assignments in the "Fundamentals" can be made.

2. Preparation.

   a. Instruction starts long before the instructor meets the trainee. If the instructor is to get across the aim of the lesson, and to make his explanations clear to the trainee, he must have thought out and prepared each step in his instruction.

b. The preparation for a flight lesson (whether or not any new maneuvers are to be introduced) includes:

(1) Reference to the outline of the particular course to determine what maneuvers the trainee should be taking up.

(2) Reference to the "Fundamentals" to determine what points the trainee should know and what questions he should be asked to determine if he has read and understood the assigned material.

(3) Determination of the points in his outside preparation to be emphasized in the ground discussion, and additional explanations to be given.

(4) Reference to the "Patter" book, to brush up on the method of explanation, and terminology, during flight instruction.

(5) Collection of charts, models, or other instructional aids to be used during instruction on the ground before the flight lesson.

(6) Outline of what will be taken up in air and ground instruction, the order in which the material will be presented, and the approximate time limits for each topic.

c. This preparation is less formidable than it sounds, and is actually a time-saver. General lesson plans can be prepared for each maneuver <u>just once</u>, and then altered as necessary to meet the individual needs of a given trainee, as determined by reference to his W.T.S. logbook, or to the instructor's Personal Logbook.

3. <u>Presentation</u> and <u>Demonstration</u>.

a. On the ground:

(1) Good ground instruction should cover the following points:

(a) The requirements of a given maneuver.

(b) How it develops from, or is different from, maneuvers introduced previously.

(c) How it is basic to maneuvers which are to follow.

(d) A description of how the maneuver is performed in terms of plane attitude and control operation, using models and charts whenever possible.

(e) An indication of some of the common errors made while learning the maneuver and how they may be avoided.

(2) Ground instruction should be an organized discussion led by the instructor, which permits an exchange of ideas and of questions and answers, but which is kept on a sequence of planned topics, by the instructor, so that no important points are missed. If possible, this discussion should be conducted in a quiet place, free from distractions.

(3) During the ground instruction, the instructor should question the trainee over the material assigned in "Fundamentals," and other C.A.A. bulletins. This procedure is a time-saver, since the instructor can then concentrate his discussion on those points which the trainee does not clearly understand.

b. In the air:

(1) Good air instruction should:

(a) Be aerodynamically correct.

(b) Be simple and clear to the trainee, using no unfamiliar or highly technical terms.

(c) Be logically organized.

(d) Include no points which could be handled on the ground before or after the flight lesson proper.

(e) Be stated so that it will have the same meaning to all trainees.

(f) Include demonstrations which are accompanied by brief instructions making specific mention of plane and ground reference points.

(2) "Patter" should be used as a guide to terminology, and to order and method of presentation. "Patter" was written, reviewed, and rewritten literally dozens of times, on the basis of experience gained from its use in actual flight instruction.

2. Try-out and Practice.

a. The purpose of the try-out is to determine if the trainee understands the maneuver, and performs it correctly.

b. Practice is to enable him to make habitual the correct performance of the maneuver.

(1) The trainee's practice should be directed so that his particular difficulties will be overcome.

(2) Even though a trainee may be performing a maneuver correctly, continued practice on that maneuver is not wasted, since it will reduce the chances of later forgetting, and will aid in making his control operations "automatic."

5. Review and Evaluation.

a. Review is necessary, since forgetting occurs in learning to fly as well as in other learning situations.

b. During all dual periods when maneuvers are "tried out" or practiced, the instructor should evaluate the trainee's performance. Methods of evaluation are outlined below. However, it should be noted here that:

(1) The over-all performance of a maneuver should be evaluated first: Whether the trainee followed ground reference points, met precision requirements, etc.

(2) The specific errors should then be discussed, e.g., errors in control movements, slipping, skidding, etc., with specific explanation as to how these errors are out of accord with the fundamental principles underlying the maneuver.

c. Review should take place not only in the air, but also on the ground at the completion of the flight, during which time the trainee's performance is discussed, the maneuvers to be taken up in the next session stated, and assignments in the "Fundamentals" and other C.A.A. bulletins made. Like pre-lesson ground instruction, this period should be an organized discussion, in which the trainee has an opportunity to ask questions.

D. Evaluation of trainee performance.

1. Inaccurate evaluation of trainee performance has three main causes:

a. Failure to look for the right things.

b. Failure to record accurately what was observed.

c. Failure to evaluate the performance adequately, either for the trainee's benefit, or for grading purposes.

2. Evaluational procedures have two purposes:

a. Analysis of trainee's performance for instructional purposes.

b. Analysis of trainee's performance for grading or rating purposes.

3. Whether evaluation is for instructional or grading purposes, the observational procedure is the same. The instructor, that is, must look for the right things. This can best be accomplished by the development of an organized system of observation.

   a. Break down maneuvers into logical units (such as entry, turn, and recovery) and whenever possible note errors during the trainee's performance of each part.

   b. Classify the errors found in each part of the maneuver, for example, as follows:

      (1) Control operations.

         (a) Errors in application of pressures.

         (b) Errors in timing.

      (2) Precision.

         (a) Errors in maintenance of direction, turn, angle of bank, etc.

         (b) Errors in altitude control.

         (c) Errors in ground pattern.

      (3) Judgment and planning.

         (a) Failure to show evidence of having planned flight path.

         (b) Failure to observe safety precautions.

   c. Make observations in terms of specific aspects of performance ("leads with rudder in entry") rather than in terms of general characteristics ("poor coordination").

   d. Record accurately what is observed, i.e., use an organized system of note-taking while in the air.

      (1) The "Ohio State Flight Inventory" represents an organized procedure for making observations, developed through research so that the most important aspects of performance are noted.

      (2) Small 5x8 cards have been found by many experienced flight instructors to be useful for note-taking while in the air.

4. Evaluation of performance for instructional purposes.

   a. The over-all performance should be evaluated first.

b. Then specific faults should be analyzed, and their effect on the over-all performance pointed out. The "Flight Inventory" should be gone over, with the trainee, at the completion of all flights in which it is used.

c. "Families of errors" should be particularly noted.

(1) "Families of errors" occur when certain errors appear in the execution of several maneuvers which can all be traced to a common cause, e.g., skidding in all maneuvers involving turns, due to improper use of rudder, failure to "feel" approaching stalls resulting in poor breaks on stalls, bad landings, steep climbs, etc.

(2) Particular attention should be given to correcting the underlying cause when families of errors are discovered.

(3) If the same "family of errors" appears in several of the instructor's trainees, some deficiency in the instructor's teaching methods may be indicated.

5. Evaluation for grading purposes.

a. When evaluation of flight performance is made in terms of comparison with other trainees, (e.g., check flights) all trainees should be required to perform the same maneuvers in the same sequence. The check flight situation, that is, should be standardized.

b. Standards of performance should be held constant.

(1) If care is not taken, standards may tend to shift:

(a) From day to day, according to the instructor's mood.

(b) From stage to stage.

(c) From trainee to trainee, e.g., an average trainee rated immediately after an outstanding trainee may receive too low a rating.

(2) Use of the "Flight Inventory" helps solve the problem confronting the inexperienced instructor in determining what constitutes a "good," "average," or "poor" trainee since evaluation is in terms of observed performance rather than ratings. These records of observed performance of a number of trainees can then be compared to determine the relative standing of members of the group.

(3) When a trainee's progress is being evaluated, the following points should be noted:

(a) Application of principles learned in previous maneuvers (e.g., safety precautions, correction for drift, etc.).

(b) Recognition of new variations of previously learned control applications.

(c) Rapidity with which errors drop out with continued practice on certain maneuvers.

(d) Persistent recurrence of old errors.

(e) Speed with which the trainee "catches on."

6. The problem of rating flight performance.

a. The W.T.S. logbook calls for ratings, after each flight, of the trainee's performance on all maneuvers practiced during that flight. These ratings are made in terms of a grading system having a range of five points, as follows:

1 - Excellent
2 - Above Average
3 - Average
4 - Below Average
5 - Poor

b. The purpose of any rating system is to differentiate individuals in respect to the performance on which they are being rated. In the flight instruction situation, the rating system is designed to bring out differences in flying proficiency which exist among trainees.

(1) In order for differences to be made most clear, as much of the total range of ratings as possible should be used.

(2) This fact makes clear that the tendency of many flight instructors to use only two or three of the five possible ratings is an inefficient rating procedure. (For instance, one study of inspectors' ratings of 36 trainees showed that 32 were given a grade of either 75 or 80, the other four being given 70. This obviously did not differentiate between individual trainees, but merely lumped the bulk of them into two groups.)

c. The rating or grade given to a trainee will depend on the standard of performance with which he is being compared.

(1) Two standards could be used in rating a group of trainees, i.e., the performance of individual trainees in the group could be compared with:

(a) The performance of a large group of trainees who had completed the flight course.

(b) The performance of a large group of trainees having the same amount of training as the man being rated.

(2) The advantages and disadvantages of these two types of standards are:

(a) Standard: Proficiency at end of course.

- Advantage: Improvement can be shown by the progressive improvement in rating from stage to stage.

- Disadvantage: The entire range of ratings will probably not be used in rating trainees at any one stage, e.g., during Stage A, even the best trainees would seldom be rated better than 3 on certain maneuvers.

(b) Standard: Proficiency of a group having same amount of training as those being rated.

- Advantage: The entire range of ratings can be used in rating a group of trainees at any stage in their training.

- Disadvantage: Improvement is not so readily shown, since the trainee who improves normally will show no improvement in his ratings from stage to stage.

d. W.T.S. officials have stated that ratings are to be made <u>in terms of what could be expected of a group of trainees having comparable training to those being rated</u>.

> CAUTION: Check this point with your resident supervisor. W.T.S. procedures change from time to time.

(1) Thus, the "standard" against which trainees being rated are to be compared is represented best by the various levels of performance the instructor has found in previous trainees he has instructed.

(a) This may present some difficulty to the inexperienced instructor, since he has not trained enough trainees to develop a basis for comparison. Until experience is gained he may:

- Use as a tentative standard the performances of the men with whom he trained, in various C.P.T. courses.

- Refer to his list of errors commonly made in a specific maneuver. The number of these errors made by a given trainee can then be considered in giving him a rating.

(2) It should be remembered that when this standard (comparison with the group) is used:

(a) Average progress from stage to stage will be indicated by similar ratings from stage to stage, and not by improvement in ratings.

(b) The entire range of ratings should be used, so that the greatest possible differentiation between trainees may be made.

- If a large group of trainees were being rated on a given maneuver there should be 1's and 5's as well as ratings of 2, 3, and 4. This is because in a large group of trainees with equal number of hours of flight there must be some who are outstandingly bad.

- Certain small groups of trainees may not contain very good or very poor trainees, so that the instructor should not "force" his ratings. He should remember, however, that 1's and 5's are included in the scale, and should be used in rating the extremely good, and the extremely poor trainee, respectively.

(3) Two implications of ratings in terms of a group of trainees having comparable training to the individual being rated are:

(a) The statement made frequently by instructors that, "If a trainee were rated '1' he would be perfect so there would be no use of training him further," is grossly inaccurate.

(b) Just because a trainee is given a '1' in a maneuver in Stage A does not imply that further improvement is impossible. It merely indicates that in comparison with others having the same training, the trainee's performance is extremely good.

SAMPLE PAGE FOR THE INSTRUCTOR'S PERSONAL LOGBOOK

Presented below is a sample of the type of page (or card) that is to be kept on each individual trainee by the instructor. Such pages (or cards) may be mimeographed in advance by the instructor or flight operator and kept for use throughout the training of an individual. The spaces are filled in with sample comments.

This book is to be kept for the instructor's personal use, i.e., its contents are not to be shown to unauthorized individuals. Its sole purpose is to aid the instructor in making accurate preparation for a given flight lesson with a particular trainee. Such a logbook prevents the instructor's forgetting specific errors and good points of a particular trainee.

It must be remembered that this logbook is not a "rating" or a "grading" device. It is an aid to proper instruction only.

LESSON NUMBER 13

NAME OF STUDENT John Jones Date 3/20/43

COMMENTS ON TODAY'S LESSON

(Put down both good points and errors in control use, precision, planning, safety, etc.)

Good orientation. Planned entire flight path so there was no wasted time. Failed to clear adequately on take-off. General precision average for this amount of training. Poor feel for stall. Enters glide too fast. Fails to slow up glide.

ASSIGNMENT FOR THE NEXT LESSON

(Definite points to be discussed and why they are brought up at this time.)

Introduction to spins. Must emphasize feel on stalls before taking up spins.

REVIEW IN THE AIR AND ON GROUND--FUNDAMENTALS, ETC.

Glides with emphasis on entry to glide and less speed. I think he is afraid of stalling. Must work on approach to stalls.

NEW MANEUVERS FOR NEXT LESSON

(How does the lesson just completed tie in with this new lesson?)

Spins are a continuation of stalls. Review of glides and stalls will tie in with accidental spins.

PHOTOGRAPH OF

THE FLIGHT RECORDER

and

A SAMPLE RECORD

Developed at the Massachusetts Institute of Technology under a grant-in-aid by The Committee on Selection and Training of Aircraft Pilots National Research Council.

THE FLIGHT RECORDER

The flight recorder, illustrated on opposite page (external housing removed), was designed and constructed especially for use in elementary training at the Instrument Section, Department of Aeronautical Engineering, Massachusetts Institute of Technology, under the auspices of the Committee on Selection and Training of Aircraft Pilots, National Research Council. It embodies the suggestions and specifications which have grown out of more than two years of research, sponsored by the Committee, on graphic recording of flights.

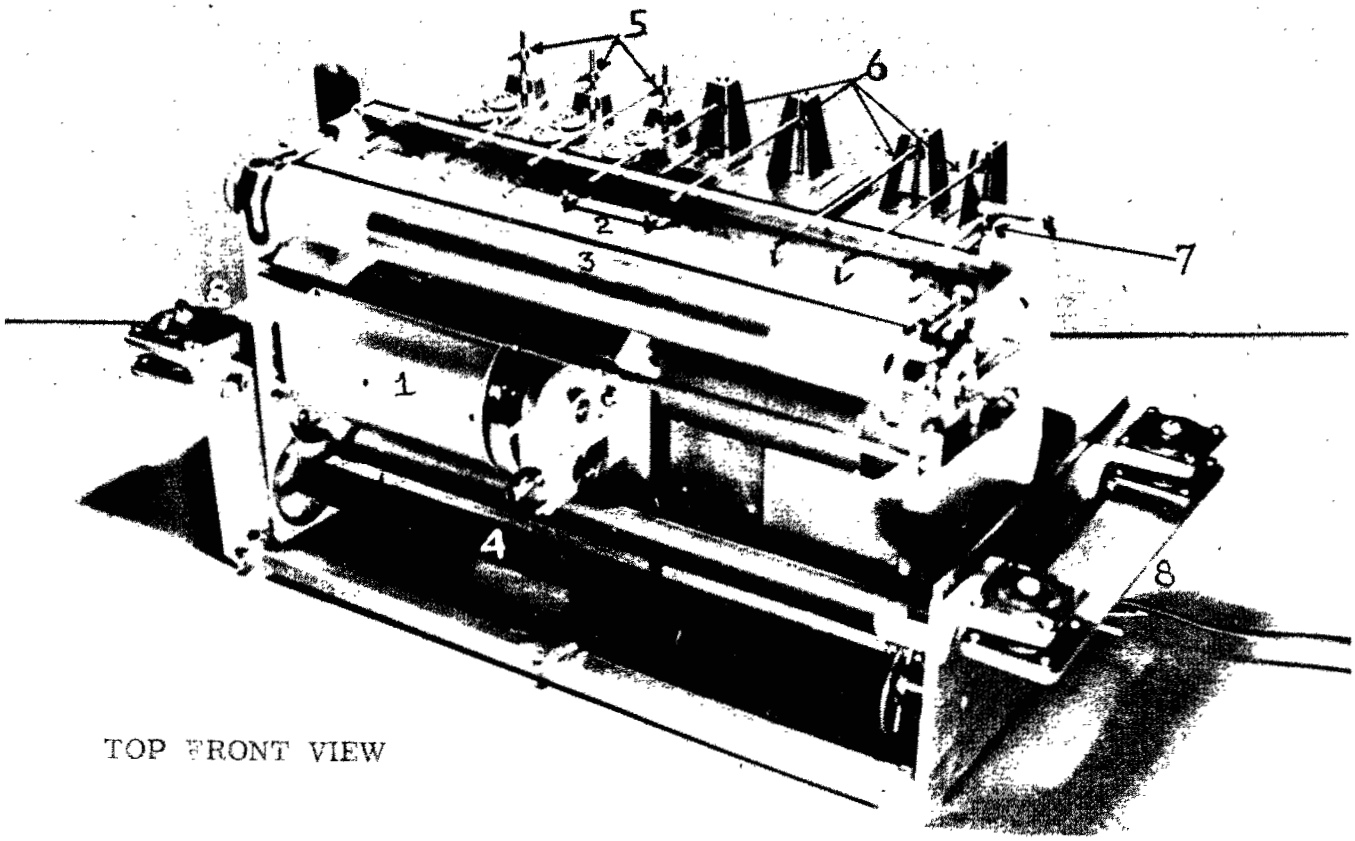
By means of metal styluses scratching on a 15" waxed paper chart (Sample of wax record appears on back of opposite page) the flight recorder provides a continuous recording of: (a) Fore-and-aft movements of the stick; (b) right-and-left movements of the stick; (c) movements of rudder pedals; (d) altitude; (e) air-speed; (f) load factor (vertical acceleration); (g) graphic ball-bank indicator (lateral acceleration); (h) code signals for identifications.

Functions a, b, and c are recorded by stylus (5). Functions d, e, f, and g are recorded by styluses (6). Function h is recorded by stylus (7). All functions are recorded in calibrations applicable to Army, Navy, and C.P.T. basic training specifications.

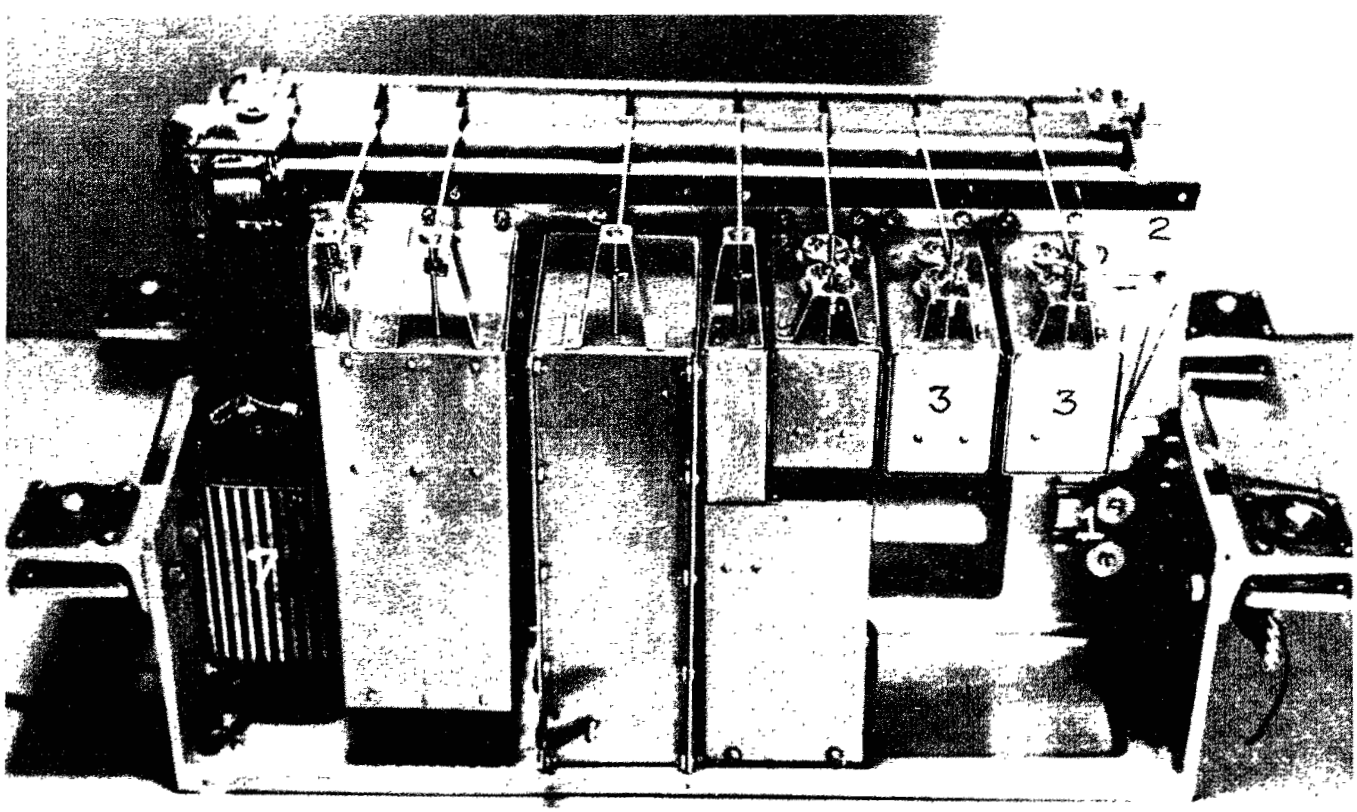
The wax chart is propelled across the tracking plate (2) and timing roller (3) to the take-up roller (4) by a spring-wound governor-type clock enclosed in a housing (1). The standard chart speed is 3" per minute which may be increased to 6" per minute by changing gears. Shock mounts (8) are provided for installation in the airplane.

The rear view of the Flight Recorder illustrates the underlying principles which make this instrument particularly useful in field work. Except for the normal and lateral accelerometers, which are enclosed in a common case (6), each unit is enclosed in an individual housing as follows: Housings (3) control recording units; housing (4) airspeed unit; housing (5) altimeter unit. Crank at the bottom of housing (5) provides for zero settings of the altimeter. The entire frame (2) permitting rapid removal for repair or replacement without disturbing the other units. All power required is furnished by a single dry cell (7). Pulleys (1) are provided for low friction guiding of cable connections between controls and recording units.

The Flight Recorder has not yet been put to field use, having only recently been completed. It is anticipated, however, that it will serve as a useful adjunct in day-to-day instruction or in flight tests, and provide the instructor with detailed and objective information about the way the trainee handles the airplane in either dual or solo flight.

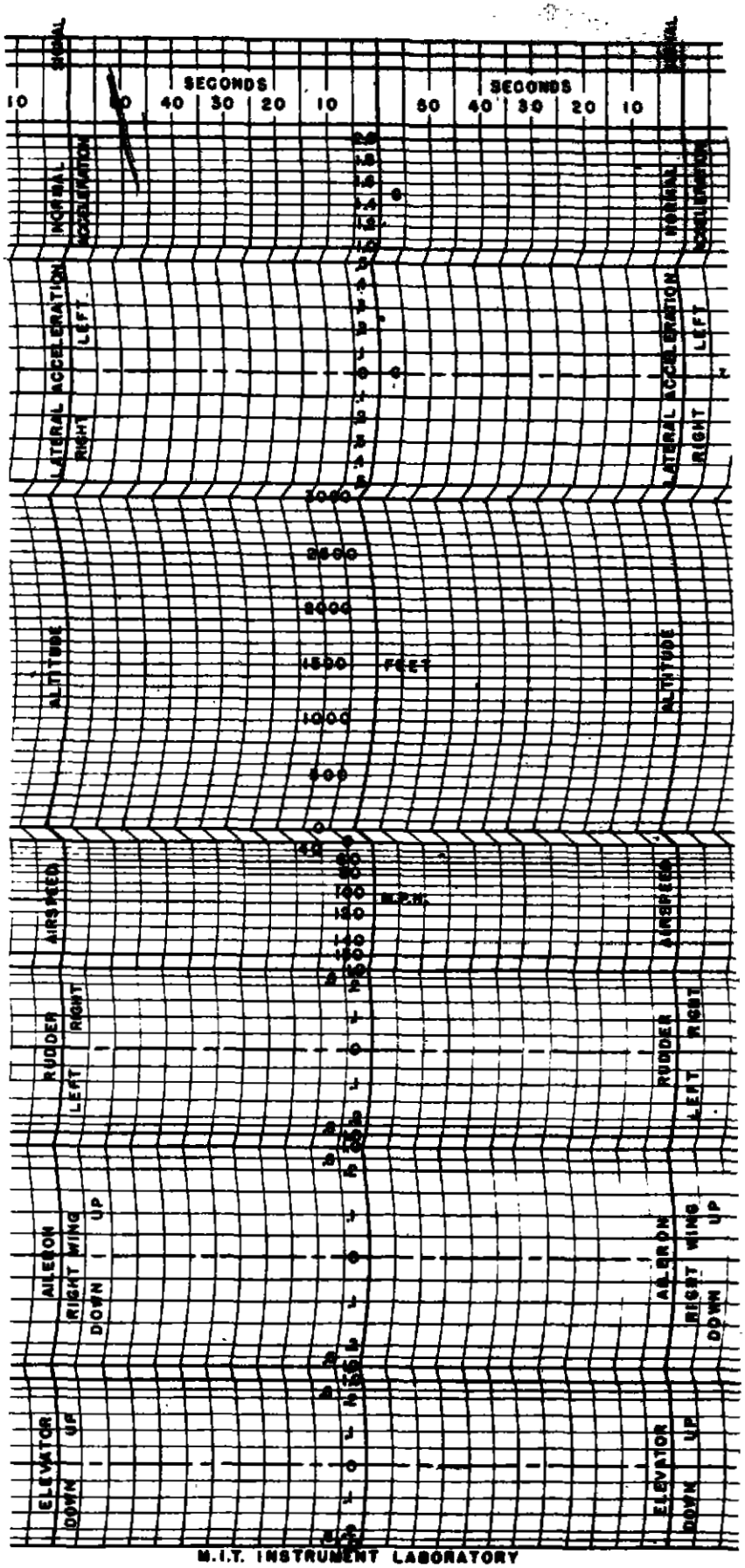


TOP FRONT VIEW



TOP BACK VIEW

FLIGHT RECORDER



SECTION OF CHART USED IN FLIGHT RECORDER

DESCRIPTION OF MOTION PHOTOGRAPH OF GOOD AND BAD PERFORMANCE ON SELECTED MANEUVERS FROM A FLIGHT TEST, REEL 2

(For Methods-Instructor)

I. Description of film.

These motion photographs were taken at Port Columbus, Columbus, Ohio, in connection with the Midwest Project of the National Research Council Committee on Selection and Training of Aircraft Pilots.

A description of the instruments in the camera field may be found in the exhibit entitled "A Photograph of the C.A.A.-N.R.C. Piper Cub Instrument Panel."

The film presents selected maneuvers from check flights made by C.P.T. trainees just previous to the completion of their primary instruction. The selected maneuvers, which are identified by a card in the upper left-hand corner of the projection field, are:

1. Take off.
2. Climbing Turn.
3. 360° Steep Turn to the left.
4. 360° Steep Turn to the right.
5. Stall.
6. Glide.
7. Medium Turn to the left.
8. Medium Turn to the right.
9. Straight Climb.
10. Straight and Level.
11. Landing.

The following points, regarding the maneuvers photographed during the two flights, should be noted:

PILOT #5. Relatively Poor Performance.

Take-off:	Flew the plane off, although control movements not smooth. Considerable uncoordinated aileron movement just after leaving ground.
Climbing Turn:	Banked to 30° on entry, then shallowed off to 15°. Slipped during turn, due to holding of "top rudder."
360° Left steep turn:	Slipped on entry, due to insufficient rudder and rough application of aileron pressure. Banked too steeply, apparently losing control, nose dropped and lost altitude rapidly. Recovery accompanied by marked aileron skid.
360° Right steep turn:	Nose high during turn, and a slight, but continuous slip. 45° bank maintained.

Stall:	Break apparently not "clean." Corrected for low wing by rudder pressure, but use of aileron pressure also evident.
Glide:	70 mph. Directional control only fair.
Left Medium banked turn:	30° bank. Entry and recovery smooth except for slight slip on entry.
Right Medium banked turn:	30° bank, slight slip on entry, pronounced aileron skid on recovery.
Climb:	Angle of climb probably too steep -- rate of climb slow. Tendency for low right wing evident.
Straight and Level:	Satisfactory.
Landing:	Failed to hold stick back after plane was on ground.

PILOT #10. Relatively Good Performance.

Take-off:	Flew plane off.
Climbing Turn:	Shallow bank -- rate of turn varied.
360° Left steep turn:	60° bank obtained, but pilot held top rudder, lost altitude. Degree of bank varied to 45°, slight skid evident on recovery.
360° Right steep turn:	In general good, except for fact that relationship of nose to horizon varied somewhat.
Stall:	Clean break, no aileron pressure used in raising low wing.
Left Medium banked turn:	30° bank. Nose slightly high during turn. No slip or skid.
Right Medium banked turn:	30° bank. Nose slightly high during turn.
Climb:	Air Speed 55 mph. Right wing slightly low.
Straight and Level:	Slight loss in altitude.
Landing:	Good.

W.T.S. Controlled Secondary Instructor Course

SELF-AUDIT FOR FLIGHT INSTRUCTORS

Even experienced instructors find that it is a good thing to "take stock" of themselves periodically in order to prevent occasional slip-ups from becoming bad habits. This blank has been designed to aid you in "auditing" your daily instruction methods so as to point out your strengths and weaknesses as an instructor.

Since no one instruction session will give a true picture of your general practices, space is provided for you to check yourself on a series of four consecutive sessions. Use Column 1 for the first session, Column 2 for the second, etc.

After each session, review carefully what happened, and answer the questions on the accompanying sheet, using the appropriate column:

1. If the answer to the question is clearly "YES", place a check mark in the square following the question.

2. If the answer is "NO", leave the space blank.

3. If you really tried to follow the procedure in question, but were not very successful, place a question mark in the square.

If for every one of the series of four consecutive instruction sessions you are honestly able to put a check mark opposite a question you can be fairly certain that you are consistently adhering to the correct instruction practice covered by the question.

On the other hand, the appearance of a number of blank spaces or question marks after a given question should be a danger signal to you, indicating that you have a tendency to neglect this practice or that you are having difficulty carrying it out. If the latter, consult your chief instructor or talk it over with your associates.

Remember, NO ONE IS PERFECT BUT EVERY ONE CAN IMPROVE.

SELF-AUDIT FOR FLIGHT INSTRUCTORS

	Instruction Sessions			
	1	2	3	4
A. BEFORE THE SESSION STARTED.				
1. DID I prepare myself by reviewing my notes on the trainee's previous lessons so as to get ready for this particular student?	☐	☐	☐	☐
2. DID I have a clear idea as to exactly what I wanted to accomplish during the session?	☐	☐	☐	☐
B. BEFORE LEAVING THE GROUND.				
1. DID I review the past lesson (or lessons) with the trainee?	☐	☐	☐	☐
2. DID I make sure the trainee had a clear idea as to what was to be done during the session?	☐	☐	☐	☐
3. DID I give all possible instruction on the ground, reviewing the Fundamentals of Basic Flight Maneuvers, diagrams, discussing the maneuvers, etc.?	☐	☐	☐	☐
4. DID I check to make sure the student understood the key points of the maneuvers to be practiced?	☐	☐	☐	☐
C. IN THE AIR. (Dual)				
1. DID THE student understand clearly what I wanted him to do?	☐	☐	☐	☐
2. DID I use the correct "Patter" in describing the maneuvers being taught?	☐	☐	☐	☐
3. DID I give a good demonstration of the correct method of performing the maneuvers?	☐	☐	☐	☐
4. DID I analyze the student's performance into its specific strong and weak points?	☐	☐	☐	☐
5. DID I make sure that my criticisms were helpful rather than merely critical?	☐	☐	☐	☐
6. DID I praise the trainee when he gave a good performance and identify what he did well?	☐	☐	☐	☐
7. DID I keep on the alert for signs of student fatigue, tension, discouragement, etc.?	☐	☐	☐	☐
8. DID I use the time in the air efficiently, i.e. no unnecessary back-tracking, maneuvering around for position, unnecessary discussion, etc.?	☐	☐	☐	☐

SELF-AUDIT FOR FLIGHT INSTRUCTORS page 2

D. ON THE GROUND (after the instruction flight)

	Instruction Sessions 1	2	3	4
1. DID I review the performance with the trainee, evaluating his progress to date?	☐	☐	☐	☐
2. DID I "look forward" to his next lesson, suggesting what he could do to prepare for it?	☐	☐	☐	☐

E. GENERAL EVALUATION OF MY INSTRUCTION METHODS TO DATE. (On the basis of this series of instruction sessions.)

1. DO I adapt my teaching techniques to the specific problems of each trainee? ☐
2. DO THE sessions accomplish what they are planned to accomplish? ☐
3. IN GENERAL are my instruction methods improving? ☐
4. The instruction techniques I am going to concentrate on in the future are the following:

   a. _____

   b. _____

   c. _____

PHOTOGRAPH OF

C.A.A. - N.R.C. PIPER CUB INSTRUMENT PANEL

Taken from Part I of An Analysis of Photographic Records of Pilot Performance, January 1943, by Viteles, M. S., Thompson, A. S., and Ewart, E. S. This study was undertaken at the University of Pennsylvania, Philadelphia, Pennsylvania, under the auspices of the Committee on Selection and Training of Aircraft Pilots, National Research Council.

PHOTOGRAPH OF C.A.A. - N.R.C. PIPER CUB INSTRUMENT PANEL

These photographs were taken to provide information concerning the control adjustments made by the pilot during flight and on the attitude and flight of the plane.

It will be noted that a special instrument panel has been prepared for use in these studies, as follows:

(1) Special Instrument Panel (mounted over left half of standard panel).
   a. Top row, left to right: Suction gauge (for testing turn and bank indicator and gyro horizon); Airspeed indicator; rate of Climb Indicator; and Sensitive Altimeter.
   b. Bottom row, left to right: Tachometer; Gyro-Horizon; Turn and Bank Indicator; Switch for Suction Gauge.

(2) Pennsylvania Control Recorder (mounted below special panel):
   a. The top scale is the Rudder Pointer; the middle scale, the Ailerons pointer; the Bottom scale, the Elevators pointer. A 'Multiplier' is located behind and beneath the Control recorder. It must be noted that the 'measuring units' for the control indicators which appear in the photograph are merely units set up for interpreting the films, i.e., they are not inches of movement, pounds of pressure, etc.

(3) Identification Data:
   a. The card in the upper left of the panel identifies the pilot by code number and the flight by letter, e.g., 620 A.
   b. The number appearing above the Control Recorder identifies the maneuver being photographed.

The photographs taken by the motion-picture camera embrace a slightly larger camera field and include the head and shoulders of the pilot and a greater portion of the front seat throttle and control stick. In improvements made after this photograph was taken, a signal light (indicating that the check pilot had taken over) was mounted above the special instrument panel and the maneuver identification number was enlarged and moved to the right of the Control Recorder.

CAMERA FIELD -- PIPER CUB INSTRUMENT PANEL

Subject No. Flight