THE FLIGHT INSTRUCTOR'S VOCABULARY

by

E. LOWELL KELLY

A report on research conducted at Purdue University, Lafayette, Indiana, by means of a grant-in-aid from the Committee on Selection and Training of Aircraft Pilots of the National Research Council, from funds provided by the Civil Aeronautics Administration.

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Committee on Selection and Training of Aircraft Pilots

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LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

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

Committee on Selection and Training of Aircraft Pilots

October 11, 1943

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

Dear Dr. Brimhall:

Attached is a report entitled The Flight Instructor's Vocabulary, by E. Lowell Kelly. The report is submitted by the Committee on Selection and Training of Aircraft Pilots with the recommendation that it be included in the series of technical reports issued by the Division of Research, Civil Aeronautics Administration.

The report presents the results of exploratory research conducted in 1941-1942. Since a small number of cases is involved, findings cannot be considered as definitive. Moreover, changes in points of view have occurred as a result of more recent investigations. Nevertheless, the study is of interest as a pioneer investigation of flight instruction methods which finally led to the development of Patter and Fundamentals of Basic Flight Maneuvers now used so extensively in pilot training by the armed forces.

Cordially yours,

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

MSV:rm

EDITORIAL FOREWORD

Among the major outcomes of research conducted by the Committee on Selection and Training of Aircraft Pilots is the preparation of two aids to flight instruction known as PATTER and Fundamentals of Basic Flight Maneuvers. The present report describes one of the studies which served as the background for these training aids.

PATTER is a small booklet used by instructors in order to make certain that uniform and standard presentation and terminology are used during flight training. The Fundamentals consist of sheets bound in looseleaf form containing a brief description of the basic points of each maneuver for study by the student on the ground prior to each period of flight instruction. Both of these aids are being used extensively in the War Training Service Program of the C.A.A. and in the instruction of Navy pilots.

A significant feature of both of these aids is that they were the outgrowth of careful studies of flight instruction as given in the air by experienced pilots. These studies were greatly advanced by a method of recording the actual instruction in the air by transmitting it to the ground by radio. This made is possible to analyze in detail the terms and phrases actually used during instruction. One phase of this analysis is presented in the attached report which describes the vocabulary used by four instructors in the first 10 hours of flight training and which reveals interesting variations among instructors with respect to word usage. The report also describes in greater detail than do earlier reports the exact equipment and procedures employed in air-to-ground recording, including steps taken in the development of the Magnetic Wire Recorder which shows great promise as an instrument for further investigations.

This early investigation sponsored by the Committee on Selection and Training of Aircraft Pilots has already had a far-reaching influence on flight instruction. The methods discussed are being used in current research and show promise of contributing further to the important objective of improving the quality of flight instruction.

This study was conducted at Purdue University, Lafayette, Indiana, in 1941 and 1942.

CONTENTS

SUMMARY

This is a report of a preliminary investigation of the words and phrases peculiar to aviation which are used by instructors during the first 10 hours of primary flight training. The study is aimed at an eventual standardization of vocabulary for flight instructors, and incidentally at the development of an improved recording method of studying flight instructional practices.

This study was part of an investigation of flight instruction in which conversation between instructor and student in the plane was transmitted to a recording unit on the ground. The entire apparatus consisted of three parts: (1) a combination electrical interphone and high-frequency, low-power transmitter; (2) a standard amateur communications receiver; and (3) either an Ediphone or a Rieber Sound Recorder. In all, about 150 hours of flight instruction were recorded.

An analysis was made of the records of 42 hours of dual instruction by four flight instructors, each of whom trained one student through to his first solo flight. From written transcriptions of these recordings, tabulations were made of all terms used by instructors which were unfamiliar to the lay reader. The terms and phrases were then grouped with reference to particular aspects of flying, and summarized with reference to the total number of times they were used by each of the four instructors.

It was found that:

1. In the course of 42 hours of dual instruction, the four instructors used approximately 496 terms and phrases which were not familiar to the layman.

2. They employed 160, 247, 240, and 244 different terms, respectively.

3. Of the 496 terms and phrases, 283 were used by only one instructor; 70 were used by all four instructors; and 172 were used only a single time by only one of the instructors.

4. The extent to which instructors' vocabularies vary is illustrated by the fact that 40 different terms and phrases were used for turns; 23 for banks and rolls; 19 for "reducing power"; 14 for "increasing power"; etc.

5. These four instructors seemed to train the student primarily in terms of control movements and pressures rather than in terms of getting the desired response from the plane.

A supplementary analysis of these data was made in regard to those terms which were used 30 or more times during the 42 hours of flight instruction, i.e., in regard to those terms which appeared to be useful in

approximately 75% of the lesson hours. The number of instructors using each of these terms and the frequency of its use were analyzed.

It was found that:

1. In the course of 42 hours of instruction a "nuclear vocabulary" of 63 words having a total frequency of use of 7,939 was employed by the four instructors.

2. This "nuclear vocabulary" stands in a ratio of 1 to 7 against the total or "occasional vocabulary" and accounts for 78% of the total frequency with which all terms and phrases were used.

3. The ratio of average use in the "nuclear" as against the "occasional" vocabulary was found to be 25 to 1.

4. The "nuclear vocabulary" of 63 words was not ideal as a basic vocabulary for primary flight instruction because not all of the instructors used all of the terms, and many of the phrases and terms were approximate synonyms.

5. The total or "occasional vocabulary" is far too large, shows too large a variability in usage, and contains too high a percentage of approximate synonyms to be highly efficient for instructional purposes.

It must be kept in mind that these findings are based on the pre-solo dual instruction of four instructors preparing four students for solo. This limited sampling of instructors does not permit conclusions concerning either the generality of the findings or the goodness of the flight instruction practices reflected in the analyses.

THE FLIGHT INSTRUCTOR'S VOCABULARY
A STUDY OF WORDS AND PHRASES USED IN FLIGHT INSTRUCTION

INTRODUCTION

In spite of its relatively brief history, aviation, like all other specialized fields, has developed a specialized vocabulary that must be learned by anyone who expects to make progress in the field. This specialized vocabulary consists primarily of technical terms related to the sciences of aerodynamics, meteorology, and navigation, but it also includes many common words and phrases to which special meanings have been attached by aviators. The terms falling in this latter category might well be called "airport jargon." They include all of the colorful phrases which have a very definite meaning for the pilot or mechanic.

In times of peace, when the trainee could take all the time necessary to learn to fly, the difficulty in learning the pilot's language did not constitute a real problem. During war times, however, the speed and efficiency with which aviation personnel is trained becomes a critical factor. Many of the sources of inefficiency must be eliminated and the disturbing factors in learning to fly minimized. "Airport jargon" is one of these factors.

Presented in this paper are the results of one of the early studies of the vocabulary used in aviation training. For reasons indicated above, and also because of complaints made by students about the difficulty of understanding what their flight instructors wanted them to do, it was felt that a detailed study of the actual words and phrases used by instructors would be a contribution toward the eventual improvement of instructional efficiency.

The study is confined to the first 10 hours of dual instruction, in view of evidence that most terms are introduced during this period. The procedures here employed, however, might well prove of value in studies at all stages of training.

THE PROBLEM

The purpose of this study was to analyze the vocabularies of four instructors, each of whom kept one student throughout the first ten hours of dual instruction. While the investigation was limited in scope, it served to indicate the probable outcomes of a more detailed study and to standardize a method of investigating flight instruction.

APPARATUS

The method of recording conversations during dual instruction consisted of transmitting all instructor-student conversations to the ground via short-wave radio and then recording the conversations for further analysis.

The apparatus[1] consisted of three units: (1) a combination electrical interphone and high-frequency, low-power transmitter; (2) a standard amateur communications receiver; and (3) a sound recorder.

1. Transmission.

The interphone-transmitter unit[2] consists of a crystal-controlled battery-powered radio transmitter operating on a frequency of 31,140 kilocycles,[3]

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1 The methods used in this study have been found to be somewhat elaborate for extensive use in the field. A more recent development, the Magnetic Wire Recorder, would greatly simplify this method of studying instructional practices. This recorder was developed by the Armour Research Foundation of Chicago. It records magnetically on a steel wire .004 of an inch in diameter. Two hours of conversation may be recorded on a single pound of wire (approximately five miles). The conversations recorded on this instrument may be replayed on the same machine or they may be dubbed off onto other permanent recording devices and transcribed. The wire on the Magnetic Recorder may then be cleared (demagnetized) and used over for a new recording. Since there is no mechanical contact between the recording head and the recording medium, the apparatus will record or play back under any conditions of vibration or varying "G" load unless these are so excessive as to damage the apparatus mechanically. In cooperation with the author, the Armour Research Foundation developed a special aircraft model of the Magnetic Wire Recorder. This model is about 7 x 9 x 14 inches and weighs about 12 pounds. The case contains a two-way electrical interphone plus the recording portion only of the Armour Recorder Unit. Continuous and discrete recording up to one hour in length can be made on the unit, but if it is desired to rewind the wire, replay the recording, or "clear" the wire, the standard AC model must be used.

2 This unit was especially designed by the writer in conjunction with Mr. M. P. Mims of the Mims Radio Company, Texarkana, U.S.A.

3 Originally it had been hoped to license the transmitter on one of the high-frequency channels assigned to flying-school services, but the Federal Communications Commission indicated that this service covered only transmitters on the ground and not those in airplanes. Since continuous operation of the transmitter was planned, it was out of the question to use either 3105 or 6210 k.c., frequencies reserved for itinerant fliers. Finally permission was secured from the F.C.C. to license the transmitter as an experimental portable mobile station using the call letters W9XCF. A number of different frequencies are available for experimental investigation, and since it was not yet certain what frequency was most suitable for purposes of the experiment permission was secured to operate on either 3492.5 or 31,140 k.c. Although the lower frequency was preferable from the standpoint of transmitter design and the lack of ignition interference in reception, it had the disadvantage of requiring a relatively long antenna (about 75 feet for one-quarter wave) which would necessitate either a trailing or a reel antenna on the ship and would not afford satisfactory transmission while the ship was on the ground. A loaded antenna from cabin to fin can be made to radiate on low frequencies but is very inefficient. Because of the relatively low power available in the transmitter, this arrangement was not considered advisable. Since a quarter-wave antenna on the higher frequency is only slightly over seven feet in length and a full half-wave antenna only 15 feet, it was decided to use the higher frequency channel.

modulated by either the instructor's or the student's microphone, both of which are continuously connected to the transmitter. A portion of the audio output of the modulator unit is fed through condensers to two phone jacks permitting the instructor or the student, or both, to hear anything spoken into either microphone at the same time the conversation is being recorded on the ground. The power input to the final tube of the transmitter is about eight-tenths watt and the power output about one-half watt. The satisfactory operating range of the transmitter in the plane is about 5 miles. Readable signals are received up to 10 miles. (Because of a somewhat noisy receiving location, no attempts were made in the present study to record at distances greater than five miles.)

The most satisfactory transmitting antenna on the plane proved to be also the simplest. After several different types of antenna and locations were tried, it was discovered that an ordinary auto-whip-type antenna mounted directly alongside the baggage compartment and extending vertically up through the cabin gave all-around satisfactory results.

Ordinary close-talking microphones were used, supported from the headphone band by a light piece of aluminum tubing. The unit, complete with batteries, tubes, headphones, and microphones, weighs 19½ pounds. It is therefore within the limits of the baggage-carrying capacity of all cubs and can be conveniently mounted in the baggage compartment of the cub trainer.

2. Receiving.

The receiver was located in the second-floor room of the Administration Building of the Purdue University Airport. The receiving antenna was a half-wave doublet placed as high in the air as possible, half of it vertical and the other half horizontal in order to receive both vertically and horizontally polarized radiation from the plane in any position. This arrangement resulted in a remarkably satisfactory reception regardless of the direction, altitude, or attitude of the ship. In the present arrangement one "dead spot" was discovered, i.e., one critical angle of the plane with respect to the receiving antenna where there was a marked fade in the signal strength. This angle, however, was very small and it was rare that as much as one word of the conversations was missed as the plane passed through this angle.

3. Recording.

The recorder was also located on the second-floor room of the Airport Administration Building. The type of recorder used was a function of the uses to be made of the observations. At times the primary interest was in making a typed transcript of the observations for further analysis and for this purpose it was found satisfactory to record directly on an ordinary Ediphone accoustically fed by placing the mouthpiece in front of a loud speaker. Where the recordings were to be played back for demonstration use, a higher-fidelity recording was desired. For this latter purpose the Rieber Reference Recorder[4] which makes a continuous record one hour long on a 12-inch disk was found to be satisfactory. Typewritten transcriptions could also be made from these recordings.[5]

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[4] The Rieber Recorder is a portable recording instrument, manufactured by Frank Rieber, Inc., Los Angeles, California.

[5] A sample of these typewritten transcripts is presented in Appendix B to this report.

Practicability of the Method.

This technique is one of the first to be used in observation of actual flight instruction, and, on the whole, it proved a remarkably satisfactory method. In spite of its seeming cumbersomeness, instructors and trainees soon became accustomed to the headgear, and the adequacy of the intercommunication system was such that they were glad to wear the headgear during the instructional period. Although aware of the fact that their conversations were being "broadcast" and recorded all instructors and students seemed quickly to forget it and to talk as naturally as if they had really been "alone" in the plane. (Because of the high frequency used for the radio transmissions, the signal was not receivable on home short-wave receivers. Hence, no attempt was made to restrict the vocabulary used by either the instructor or the student!)

As was expected, considerable difficulty was encountered in eliminating engine noise sufficiently to make speech understandable. Although this problem was not solved with complete satisfaction, it was met in part by introducing an electrical filter into the audio portion of the transmitter, which served to eliminate to a very large extent the low frequencies of the engine noise.[6]

One very real limitation of this technique will be immediately apparent to all flight instructors: It does not permit the observation of hand signals which some instructors find so useful. This limitation was not crucial in the present study as all instruction took place in a light two-place tandem cabin plane and the instructors were accustomed to using "Gosport" speaking tubes rather than hand signals. Ideally a sound motion-picture record of all instructor behavior -- speech, facial expression, and bodily movements -- would be desirable, but the size and weight of such recording equipment, together with the necessity of having an operator present, makes such a record impractical, for the present at least.

TREATMENT OF DATA

Approximately 150 hours of instruction were recorded with the apparatus described above. This report, however, is based on the analysis of 42 hours of dual instruction by four flight instructors identified simply as instructor A, B, C, and D, respectively. Each of these instructed one student through to his first solo flight. The actual instructional time varied only from 10 hours for the best, to 11½ hours for the poorest student.

It is possible to make many different kinds of analyses of the typed transcripts of such recordings. This report, however, is confined to the study of what may be called the specialized terminology of dual-flight instruction. Since a complete word count of all words and phrases appearing in the 42 hours of transcription would have been extremely expensive as well as of dubious value, an attempt was made to identify those words and phrases which might be considered unique to flight instruction. To this

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[6] In related investigations of air-to-ground recording, contact-type carbon microphones were used which are insensitive to airborne noises but respond to the voice when placed against the cheek or chin. In this study, however, the planes were equipped with mufflers so that no such precautions were necessary.

end a graduate student, intelligent but untrained in aviation, was asked to read each of the transcripts and to underline each word or phrase appearing in the transcription which was not clearly meaningful to him as a lay reader. Instructions to this reader were to underline not only the technical terms unknown to him but also ordinary words used in a special sense or with unusual connotations as a part of the flight instruction.

The resulting list consisted of 496 different words and phrases considered by this intelligent lay reader to need explanation or clarification. Using this list as a master list, each of the transcripts was then re-read and a tally made each time each of these terms was used by one or more of the four instructors. Following this frequency count, the words and phrases were grouped together in relation to the particular maneuver or aspect of flying with which they were concerned, e.g., stalls, spins, parts of the plane, take-offs, etc. (A tabulation of these groupings appears in the Appendix to this paper.)[7]

RESULTS AND DISCUSSION

In Table I is presented a summary of the frequencies with which the four instructors used various general categories of words during the 10 hours of dual instruction, e.g., 12 words or phrases were used in reference to glides; all four of the instructors used 3 of these terms; six of the terms were peculiar to individual instructors and not used by the others; instructor A used 5 different terms for glides, instructor B used 8, instructor C, 5, and instructor D, 7. The tabulations of the individual terms or phrases used within each of these categories are presented in Appendix A at the end of this paper.

An examination of Table I and the appended tabulations of the individual terms or phrases within each of the categories reveals that:

1. Four flight instructors used 496 different technical terms and phrases in the pre-solo dual instruction of four students.

2. Only one-seventh of the terms, actually 70 of 496 terms, were used by all four instructors.

3. Over half, actually 283 of the 496 terms, were used by only one of the four instructors. Such terms constitute a sort of "private language" of an individual instructor.

4. Approximately one-third, actually 172 of the terms, were used only once by only one instructor. Such terms are thus not only "private" but also "rare" in the speech of the instructor using them.

5. Instructors A, B, C, and D used 160, 247, 240, and 244 different terms, respectively. Instructor A talked in general much less than the other three instructors, used a smaller total number of different terms. Apparently, however, the average student with the average instructor may expect to learn (or to hear) at least 200 new words or phrases during the first ten hours of instruction.

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7 Only the material spoken by the instructor has been subjected to analysis in this report. Terms and phrases used by the students in asking questions or replying to questions are not included in this study.

TABLE I

SUMMARY TABLE SHOWING VARIABILITY
OF VOCABULARY USED BY 4 FLIGHT INSTRUCTORS IN 10 HOURS OF DUAL INSTRUCTION

General Category*	No. of Terms in Category	No. of Terms Used by All 4 Instructors	No. of Terms Used by Only 1 Instructor	No. of Different Terms in Each Category by Instructor			
				A	B	C	D
(1) Aerodynamics	14	1	10	9	3	3	5
(2) Bank and Roll	23	2	12	4	17	9	9
(3) Glides	12	3	6	5	8	5	7
(4) Parts of Plane	15	0	11	1	4	3	11
(5) Speed	9	2	4	6	3	6	5
(6) Approaches.	7	0	4	1	3	2	6
(7) Take-offs	11	1	8	1	6	3	7
(8) Wind	13	5	5	5	7	9	8
(9) Level Flight	11	2	2	3	9	7	4
(10) Climb	9	1	2	2	8	5	5
(11) Landings	21	4	11	7	13	9	12
(12) Turns	40	7	21	10	21	22	27
(13) Mush (et al.)	13	2	6	6	6	6	3
(14) Stalls	9	2	4	6	3	4	6
(15) Spins	13	0	10	2	3	9	4
(16) Air Condition	16	0	12	4	8	5	4
(17) Dives	6	1	4	1	5	2	2
(18) Affective Terms	2	1	0	2	1	2	2
(19) Command	39	7	21	15	23	25	16
(20) Maneuvers	18	3	8	5	6	9	16
(21) Taxiing	5	1	3	1	2	2	4
(22) Airport Jargon	38	5	24	13	13	14	20
(23) Controls (General)	16	3	11	7	8	6	8
(24) Pressure	19	4	9	4	11	12	8
(25) Controls (Stabilizer)	7	2	4	3	4	3	4
(26) Rudder	20	5	13	7	9	14	7
(27) Stick	16	1	11	5	6	8	7
(28) Motor and Operation	11	2	8	1	9	2	4
(29) Motor Accessories & Parts	11	0	5	6	4	9	2
(30) Switch	12	1	7	1	6	5	8
(31) Throttle & Throttle Adjustment	10	1	6	3	6	4	4
(32) Increasing Power	14	1	9	5	7	7	3
(33) Decreasing Power	19	1	12	9	5	9	8
	496	70	283	160	247	240	244

* Numbers in parentheses refer to table numbers in Appendix A.

6. The wide variation in instructors' usage of terms is indicated by the occurrence of 14 different expressions to direct a student "to increase power" and 19 different expressions "to reduce power."

7. Students were instructed to execute 10°, 15°, 20°, 30°, 35°, 45°, 50°, 60°, constant, medium, normal, shallow, steep, and vertical "banks."[8]

8. Similarly, students were asked to make 33 different types of turns: air, complete, downwind, full, climbing, maximum climbing, normal climbing, steep climbing, right climbing, gliding, hairpin, half, left, medium, normal, normal precision, normal curve, ordinary, precision, right, right hand, "S", shallow, spiral, steep, steep-banked, steep turn off-side, 20°, 30°, 45°, 90°, 180°, and 360°.

9. These four instructors seem to teach students primarily in terms of control movements and pressures rather than in terms of getting the desired response from the plane. Thus, in turns, a student is usually told to "hold back pressure" rather than to "hold the nose up on the horizon," and in landings to "pull the stick back" rather than to "get the tail down."

10. Recent emphasis on the use of control pressure rather than control movements is reflected in a total of 18 different "pressure expressions," but the frequency count shows that such expressions were used only about one-fourth as often as direct commands to move the controls themselves.

11. Students sometimes experience difficulty in understanding what an instructor means by a given expression. It is, however, perhaps fortunate that they are unable to execute the instructions literally: e.g., "pull the throttle off," "roll the stick and rudder," "go off on a wing," "kick your throttle," and "kick out motor."

The foregoing analysis immediately raises several other questions of interest in such an analysis of the flight instructor's vocabulary:[9]

1. In spite of the wide variety of terms which instructors in primary training tend to use, is there a relatively small "nuclear vocabulary" which bears the burden of instruction?

2. What is the ratio between the number of terms in such a basic or "nuclear vocabulary" and the number in the total or "occasional vocabulary"?

3. What is the ratio in <u>use</u> of these main groups of terms and phrases?

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8 One wonders how accurately the instructors themselves could have followed all instructions!

9 These questions, as well as the following analysis and discussion, were formulated by Dr. Walter R. Miles, and do not necessarily reflect the interpretations of the author.

In Table II the tabulations necessary to answer the above questions are presented. The terms used 30 or more times by the four instructors during the 42 hours of instruction were selected for study. In the first column is given the table number (see Appendix A) from which the term has been taken; the second column lists the name of the particular term or phrase; the third, the frequency of use by the four instructors; and the fourth (last) column indicates the instructors or instructor using the term. The frequency of 30 was arbitrarily chosen because in 42 hours of instruction, 30 appearances of a given word or phrase would indicate the usefulness of this particular term in approximately 75% of the lesson hours.

It will be noted that 63 of the total of 496 terms meet this criterion. This is only about 12.7%, or a ratio of 1 to 7. This might be said to indicate that the ratio of "occasional" words to those that are highly necessary and critical for the instruction of primary students is much too high for best economy and efficiency in primary instruction where smooth and rapid learning is the objective to be obtained.

It must be realized, however, that flying instruction must emphasize certain general categories of terms much more than others. It will be noted that the 63 terms which meet the criterion frequency of 30 are drawn from only 24 of the 33 tables presented in Appendix A. It is obvious that terms concerned with landing, turning, and various commands (Table 19) will need to be repeated more often than terms having to do with aerodynamics or parts of the plane.[10] The term "stick," however, is one notable exception to this statement (Table 27). It will be also noted that this is the most frequently used term of those analyzed. Perhaps this is by reason of the fact that there is no synonym for it; it is short and distinctive and instructors feel no need for varying it.

When the frequencies of all terms for all instructors are totalled for the 33 tables in Appendix A, it is found that a total of 10,132 terms and phrases appeared in the transcribed copy from the 42 hours of flight instruction. The frequency of use of the 63 words (Table II) accounts for a total of 7,939, or 78% of this grand total. These 63 words and phrases are therefore used on the average of 126 times apiece, whereas, the remaining 433 words were used on the average, only 5 times apiece.

Further analysis of these data, however, suggests that this 63-word "nuclear vocabulary" is not ideal within itself. For instance: only 40 of these terms were used by all 4 of the instructors; 13 more were used by only 3 instructors; 8 terms by only 2; and 2 of the terms by only 1 instructor. This clearly indicates a degree of variability between

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10 These characteristics may or may not be true of other samples of instruction. These figures indicate that there is a small "nuclear vocabulary" which bears the burden of pre-solo dual instruction.

TABLE II

INDIVIDUAL TERMS OR PHRASES USED 50 OR MORE TIMES

From Table No (Appendix A)	Individual Term or Phrase	Frequency of Use	Instructors Using the Term or Phrase
(2)	bank	290	all
(3)	glide	134	all
(3)	normal glide	53	all
(3)	gliding	103	B,C
(5)	flying speed	55	all
(7)	take-off	342	all
(7)	taking off	42	B,C
(8)	down wind	57	all
(8)	into the wind	115	all
(9)	level flight	88	all
(9)	straight (flying or flight)	34	A,B,C
(9)	(keep it) straight	129	D
(10)	climb	205	all
(10)	normal climb	43	B,C,D
(10)	climbing	80	B,C
(11)	landing	325	all
(11)	land	209	all
(11)	forced landings	57	all
(11)	levels off	131	all
(11)	leveling off	33	B,C
(11)	level out	65	A,B,C
(12)	turns	358	all
(12)	turning	79	B,C
(12)	turn (command)	540	all
(12)	climbing turn	64	A,B,C
(12)	left turn	33	A,C,D
(12)	90° turn	123	B,C,D
(12)	180° turn	68	B,C,D
(13)	settle(ing)	158	all
(14)	stall (s)	121	all
(15)	spin (s)	85	A,C,D
(18)	tense	33	A,C,D
(19)	check	111	all
(19)	follow through	65	all
(19)	(keep) nose up	127	A,B,D
(19)	(keep) nose straight	36	A,B,D
(19)	recover (ed)	107	all
(19)	steeper	165	all
(19)	straighten out ship	57	all
(19)	(keep ship) straight	129	C
(19)	straight ahead	200	all
(20)	slip	30	all
(21)	taxiing	231	all
(22)	attitude	171	all

TABLE II (Continued)

(22)	drift	44	all
(22)	pylon	133	all
(22)	swing	33	A,B
(23)	controls	111	all
(23)	neutral position	31	all
(24)	pressure	147	all
(24)	back(ward) pressure	211	all
(25)	stabilizer	48	all
(26)	rudder	321	all
(26)	rudder pedals	41	all
(26)	right rudder	84	all
(26)	left rudder	35	all
(27)	aileron	68	A,C,D
(27)	stick	654	all
(31)	throttle	134	all
(31)	R.P.M.	34	B,C,D
(33)	cut motor	56	all
(33)	cut motor back	30	B,C
(33)	close throttle	43	C,D

Total No. terms meeting criterion = 63 — Total frequency of 63 terms = 7,939

Total No. terms in 42 hours instruction = 496 — Total frequency of 496 terms = 10,132

the vocabularies of the 4 different instructors, which, in the interest of good instructional techniques, it is desirable to reduce. It will be further noted that some of the terms in the "nuclear vocabulary" are approximate synonyms. It might be hypothesized that this feature also would cut down on the efficiency of the instruction.

This same sort of reasoning might be applied to the "occasional vocabulary" as well as the "nuclear." The "occasional vocabulary" itself is too large and contains too high a percentage of approximate synonyms to be highly efficient for instructional purposes. The "occasional" also has a very high degree of variability among the instructors.

The ratio for average use in the "nuclear vocabulary" as against the "occasional" is 25 to 1. This tremendous ratio seems out of line with any good instructional technique. To get over a technical term or phrase and have it stick and be meaningful to the trainee, it probably should be repeated in the course of instruction more than 5 times.

APPENDIX A

Presented on the following pages are the frequencies of each term or phrase used by the four instructors during 42 hours of dual instruction (approximately 10 hours for each instructor).

The words and phrases are grouped into general categories according to the aspect of flying to which they were applied.

TABLE 1

FREQUENCY TABLE OF AERODYNAMIC TERMS AND PHRASES

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
angle of attack	7				7
center of gravity	4				4
centrifugal force	1				1
drag	3			1	4
drag on wings				1	1
lag			1		1
leading edge		1			1
lift	15	1	1	2	19
loading the ship	1				1
loading the wings	1				1
propellor work		1		2	3
strain on wings	1				1
streamline			1		1
torque	2			3	8
Total	35	3	3	12	53
No. Terms Used	9	3	3	5	

Number of terms in the category	14
Number of terms used by all four instructors	1
Number of terms used by only one instructor	10

TABLE 2

FREQUENCY TABLE OF TERMS AND PHRASES FOR BANK AND ROLL

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
bank	23	102	31	99	290
banking		3			3
10° bank		5			5
15° bank			1		1
20° bank		3			3
30° bank		19	2		21
35° bank		1			1
45° bank			4	5	9
50° bank		1	1		2
60° bank		2	4		6
constant bank				1	1
medium bank			1		1
normal bank		9		2	11
over bank				1	1
shallow bank	2	12	2	12	28
steep bank		5		5	10
vertical bank		1			1
roll	2	1	1		4
roll in		3		4	7
roll it back	1	3			4
roll it out		7			7
roll the bank		2			2
slow roll				1	1
Total	33	179	77	130	419
No. Terms Used	4	17	9	9	

Number of terms in the category 23
Number of terms used by all four instructors 2
Number of terms used by only one instructor 12

TABLE 3

FREQUENCY TABLE OF TERMS AND PHRASES FOR GLIDES

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
glide	54	9	26	45	134
normal glide	7	11	21	14	53
gliding		88	15		103
coast		1			1
gliding angle	3	12		3	18
normal gliding angle				1	1
break(ing) glide	1	3	11	6	21
break (it) up (glide)			3		3
flatten out	2				2
gliding distance		2		1	3
gliding speed				1	1
nosing down		1			1
Total	67	127	76	71	341
No. Terms Used	5	8	5	7	

Number of terms in the category	12
Number of terms used by all four instructors	3
Number of terms used by only one instructor	6

TABLE 4

FREQUENCY TABLE OF TERMS AND PHRASES FOR PARTS OF PLANE

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
belt (safety)		1	2		3
brakes				1	1
control cables				1	1
elevators		1		2	3
flippers			1	1	2
fuselage				1	1
hood		1			1
keel surface				1	1
passenger	1				1
propellor		3		1	4
shock cords				3	3
tail skid				1	1
tail wheel				5	5
vertical fin				1	1
windshield			1		1
Total	1	6	4	18	29
No. Terms Used	1	4	3	11	

Number of terms in the category	15
Number of terms used by all four instructors	0
Number of terms used by only one instructor	11

TABLE 5

FREQUENCY TABLE OF TERMS AND PHRASES FOR SPEED

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
air speed	6		3	2	11
air speed indicator			2		2
constant speed			2		2
cruising speed	9	13		7	29
flying speed	11	16	17	11	55
forward speed	5				5
ground speed	3	4	8	4	17
landing speed	4				4
stalling speed			1	3	4
Total	38	33	31	27	129
No. Terms Used	6	3	6	5	

Number of terms in the category	9
Number of terms used by all four instructors	2
Number of terms used by only one instructor	4

TABLE 6

FREQUENCY TABLE OF TERMS AND PHRASES FOR APPROACHES

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
approach	3		10	14	27
90° side approach		17			17
180° approach		2	1	7	10
"prolonged 180°"				1	1
180° side approach		18		1	19
downwind approach				1	1
normal approach				1	1
Total	3	37	11	25	76
No. Terms Used	1	3	2	6	

Number of terms in the category	7
Number of terms used by all four instructors	0
Number of terms used by only one instructor	4

TABLE 7

FREQUENCY TABLE OF TERMS AND PHRASES FOR TAKE-OFFS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
take-off	53	72	90	127	342
taking off		36	6		42
cross-wind take-off			1		1
take-off path				1	1
take-off position		3			3
break ground				1	1
lift (it off) (off ground)		7			7
roll off the ground		1			1
pulled off		1		1	2
stall it off				1	1
stall out				1	1
Total	53	120	97	132	402
No. Terms Used	1	6	3	6	

Number of terms in the category	11
Number of terms used by all four instructors	1
Number of terms used by only one instructor	8

TABLE 8

FREQUENCY TABLE OF TERMS AND PHRASES FOR WIND

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
wind direction	4	1	3	4	12
cross wind	5	5	4	5	19
across wind			1		1
crossways with (to) wind		1	1		2
down wind	8	18	18	13	57
upwind			2	1	3
upward wind side		1			1
into the wind	8	49	29	29	115
windward side			1	1	2
tailwind	1				1
wind indicator		3	1		4
wind sock				1	1
velocity				1	1
Total	26	78	60	55	219
No. Terms Used	5	7	9	8	

Number of terms in the category	13
Number of terms used by all four instructors	5
Number of terms used by only one instructor	5

TABLE 9

FREQUENCY TABLE OF TERMS AND PHRASES FOR LEVEL FLIGHT

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
straight and level flight		9	7	3	19
straight and level	2	9	4	2	17
level flight	11	57	2	18	88
level flying position			2		2
flying level		5	6		11
flying position		12			12
normal flight		3	3		6
straight (flying or flight)	3	10	21		34
(keep it) straight				129	129
lateral level		2			2
level point		1			1
Total	16	108	45	152	321
No. Terms Used	3	9	7	4	

Number of terms in this category	15
Number of terms used by all four instructors	2
Number of terms used by only one instructor	2

TABLE 10

FREQUENCY TABLE OF TERMS AND PHRASES FOR CLIMBS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
climb	35	23	62	85	205
normal climb		17	16	10	43
climbs		2	1		3
climbing		50	30		80
shallow climb		1			1
steep climb	1	7	1		9
climbing angle		13		2	15
normal climbing angle				1	1
normal climbing position		1		1	2
Total	36	114	110	99	359
No. Terms Used	2	8	5	5	

Number of terms in the category	9
Number of terms used by all four instructors	1
Number of terms used by only one instructor	2

TABLE 11

FREQUENCY TABLE OF TERMS AND PHRASES FOR LANDINGS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
landing	30	133	62	100	325
land	84	7	36	82	209
accuracy landing				1	1
come in short		1			1
cross wind landing			1	1	2
float		4			4
fly into the ground		1		4	5
forced landings	1	18	11	27	57
kite				2	2
landing position	1	1			2
levels off	14	11	49	57	131
leveling off		31	2		33
level out	62	2	1		65
normal landing				5	5
nosing over			1		1
overshoot landing				1	1
run it in		2			2
shoot a landing				6	6
steps in landing		1			1
three point landing	1	3	1		5
three point contact				1	1
Total	193	215	164	287	859
No. Terms Used	7	13	9	12	

Number of terms in the category	21
Number of terms used by all four instructors	4
Number of terms used by only one instructor	11

TABLE 12

FREQUENCY TABLE OF TERMS AND PHRASES FOR TURNS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
turns	49	79	93	137	358
turning		66	13		79
turned			3		3
turn (command)	196	71	116	157	540
turn around			3		3
turn in		2			2
turn left			4		4
air turn			1		1
complete turn		2	1		3
downwind turn		1			1
full turn		1			1
climbing turn	1	8	31	24	64
maximum climbing turn	3				3
normal climbing turn		3			3
steep climbing turn				1	1
right climbing turn			1	1	2
gliding turn		1	13	10	24
hairpin turn				3	3
half turn				1	1
left turn	9		18	6	33
medium turn				2	2
normal turn		5		12	17
normal precision turn				1	1
normal curve				1	1
ordinary turn			1		1
precision turn				5	5
right hand turn		1		1	2
right turn	9	4	5	1	19
S turns	6	8	4	3	21
shallow turn	1	5	2	2	10
spiral				1	1
steep turn	2	7	10	9	28
steep banked turn				1	1
steep turn off side				1	1
20° turn		2			2
30° turn			1		1
45° turn			2	2	4
90° turn		112	6	5	123
180° turn		62	2	4	68
360° turn		3		1	4
Total	276	443	330	392	1441
No. Terms Used	10	21	22	27	

Number of terms in the category	40
Number of terms used by all four instructors	7
Number of terms used by only one instructor	21

TABLE 13

FREQUENCY TABLE OF TERMS AND PHRASES FOR MUSH (et al.)

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
mush	1	1	2	3	7
mushing			1		1
settle(ing)	56	72	2	28	158
settle in		1			1
sink	11				11
wallow			3		3
drop in (landing)	2	4		1	7
falls in (landing)	10	1			11
stall in	1				1
falls off (landing)		3			3
mushy controls			1		1
sloppy controls			2		2
Total	80	82	11	32	205
No. Terms Used	6	6	6	3	

Number of terms in the category	13
Number of terms used by all four instructors	2
Number of terms used by only one instructor	6

TABLE 14

FREQUENCY TABLE OF TERMS AND PHRASES FOR STALLS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
stall (s)	34	15	43	31	121
Stall maneuver				1	1
stalling point	3			2	5
falling stall				1	1
full stall	3				3
normal stall	1				1
power stall	5	1	7	1	13
power-off stall	1		2	4	8
stalled		1	2		3
Total	47	16	54	41	157
No. Terms Used	6	3	4	6	

Number of terms in the category 8
Number of terms used by all four instructors 2
Number of terms used by only one instructor 4

TABLE 15

FREQUENCY TABLE OF TERMS AND PHRASES FOR SPINS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
spin (s)	22		44	19	85
spinning		18	3		21
accidental spin				1	1
flat spin			2		2
normal spin		2			2
one turn spin			2		2
turn and a half spin			1		1
two turn spin				1	1
dropped wing			1		1
drops off			2		2
entry to spin			2		2
falls off	6		1	5	12
"go off on a wing"		1			1
Total	28	21	58	26	153
No. Terms Used	2	3	9	4	

Number of terms in the category	13
Number of terms used by all four instructors	0
Number of terms used by only one instructor	10

TABLE 16

FREQUENCY TABLE OF TERMS AND PHRASES FOR WEATHER AND AIR CONDITIONS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
visibility		2	2		4
air current		3		8	11
bump		1			1
thermal				5	5
down current				1	1
down draft	1	2			3
up current		4			4
up draft		3			3
dead air		2			2
rough air	1	2		2	5
smooth air	1				1
uneven air	1				1
gust			3		3
gusty			2		2
freezing			1		1
icing up			1		1
Total	4	19	9	16	48
No. Terms Used	4	8	5	4	

Number of terms in the category	18
Number of terms used by all four instructors	0
Number of terms used by only one instructor	12

TABLE 17

FREQUENCY TABLE OF TERMS AND PHRASES FOR DIVES

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
dive (d) (ing)	4	2	5	6	17
dive it		4		2	6
nose dive		1			1
pulled up from dive		1			1
pull out			1		1
zoom		1			1
Total	4	9	6	8	27
No. Terms Used	1	5	2	2	

Number of terms in the category	6
Number of terms used by all four instructors	1
Number of terms used by only one instructor	4

TABLE 18

FREQUENCY TABLE OF AFFECTIVE TERMS

Term or Phrase	Frequency For Each Instructor:				Frequency For All Instructors
	A	B	C	D	
feel	3	8	6	8	25
tense	2		16	15	33
Total	5	8	22	23	58
No. Terms Used	2	1	2	2	

Number of terms in the category	2
Number of terms used by all four instructors	1
Number of terms used by only one instructor	0

TABLE 12

FREQUENCY TABLE OF "COMMAND" TERMS AND PHRASES

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
balance	9	10	1		20
balanced it		1			1
balance ship		2			2
control spin				1	1
check	12	47	25	27	111
checked			4		4
checking		24			24
correct	2	2		13	17
follow through	28	12	22	3	65
level (plane or wings)	1	3		16	20
lift wing		1			1
shallow out				1	1
shallow off		1	12	11	24
neutralize	8	6	2	2	18
bring nose up			5		5
bring nose up in steps		1			1
lift nose		2			2
pull nose			1		1
drop nose			10		10
get nose down			1		1
keep nose down			1		1
let it down		3			3
(keep) nose level	18	104		5	127
(keep) nose straight	14	5		17	36
recover(ed)	13	1	6	87	107
start recovery			8		8
recover (from spin)			2		2
steepen	3		1	2	6
steepen your angle			1		1
steeper	19	45	59	42	165
steepest			1		1
steeply		2	3		5
shallow (er) (est)		1	5	15	21
straighten out ship	36	13	1	7	57
(keep ship) straight			129		129
straighten (up)	3		5		8
straighter			1		1
straight away	1	3			4
straight ahead	71	119	3	7	200
Total	238	408	309	256	1211
No. Terms Used	15	23	25	16	

Number of terms in the category 38
Number of terms used by all four instructors 7
Number of terms used by only one instructor 21

TABLE 20

FREQUENCY TABLE OF TERMS AND PHRASES FOR MANEUVERS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
maneuver			5	3	8
confidence maneuver			1	1	2
control maneuver				1	1
air work	2		1	1	4
coordination exercise				5	5
figure eights	5	11	13	2	29
shallow eights		3		3	6
loop				1	1
half loop				1	1
recovery (ies)	2		5	14	21
precision recovery				1	1
rectangular course		12	2		14
precision course				1	1
slip	3	1	4	22	30
foreward slip			1	1	2
side slip (ping)		9			9
skid	4	2	5	1	12
S pattern				9	9
Total	14	38	39	57	147
No. Terms Used	5	8	9	18	

Number of terms in the category 18
Number of terms used by all four instructors 3
Number of terms used by only one instructor 8

TABLE 21

FREQUENCY TABLE OF TERMS AND PHRASES FOR TAXIING

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
taxiing	15	61	92	83	251
taxi position				1	1
taxi speed		1		1	2
taxi strip				5	5
roll(in taxiing)			4		4
Total	15	62	96	70	243
No. Terms Used	1	2	2	4	

Number of terms in the category	5
Number of terms used by all four instructors	1
Number of terms used by only one instructor	3

TABLE 22

FREQUENCY TABLE OF AIRPORT JARGON AND RELATED QUASI-TECHNICAL TERMS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
attitude	15	49	30	77	171
elevation		1			1
maneuvering space				1	1
altimeter	7	2	7	8	24
altitude-meter		1			1
angle			1		1
longitudinal angle		1			1
negative angle (wing tip)	1				1
positive angle (wing tip)	1				1
blind spot		2		2	4
cardinal point				2	2
clearance		1			1
crabbing			1	6	7
cross country				2	2
cruise		1	1	4	6
cruising			3	1	4
cruising line		1			1
drag (a wing)				2	2
drift	9	5	8	22	44
dust off field				1	1
flight path				1	1
glider			1		1
hangar			3		6
heading				1	1
instrument	11	2	1	1	15
line of traffic	14				14
parachute	7			6	13
rip cord	1				1
precision				3	3
pylon	2	76	44	11	133
ramp				1	1
right of way			2		2
runway (s)			3		3
swing	4	29			33
traffic land	5				5
solo	1		2	3	6
Total	76	171	110	153	540
No. Terms Used	15	13	14	20	

Number of terms in the category	36
Number of terms used by all four instructors	5
Number of terms used by only one instructor	24

TABLE 22

FREQUENCY TABLE OF TERMS AND PHRASES FOR USE OF CONTROLS (GENERAL)

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
controls	29	21	39	22	111
control (command)	2	1		6	9
coordination	3	7	4	10	24
"blind controls"				2	2
crossed controls			5		5
opposite controls	2				2
jam the controls				1	1
lateral control				1	1
neutral position	5	11	8	7	31
over control		4	1	1	6
under control		1			1
sensitive controls	2				2
work controls			3		3
"roll stick and rudder"		1			1
sensitive nose		5			5
sensitivity	2				2
Total	45	51	60	50	208
No. Terms Used	7	8	8	8	

Number of terms in the category	16
Number of terms used by all four instructors	3
Number of terms used by only one instructor	11

TABLE 24

FREQUENCY TABLE OF TERMS AND PHRASES FOR USE OF CONTROLS ("PRESSURE")

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
pressure	34	51	28	59	147
back (ward)pressure	44	21	78	70	211
forward pressure	4	4	17	3	28
upward pressure		1			1
(Release of pressure)					
release pressure		3	5		8
release back pressure		7			7
let up on stick			7		7
let up on it			1		1
let up on her			1		1
let her up			4		4
ease up			2	1	3
relieve pressure			7		7
ease the back pressure		1		1	2
(Pressure relative to lateral control)					
aileron pressure			2	3	5
side pressure		3			3
opposite pressure		18		1	19
rudder pressure	1	1	7	13	22
release rudder		1			1
Total	83	91	152	151	477
No. Terms Used	4	11	12	8	

Number of terms in the category	18
Number of terms used by all four instructors	4
Number of terms used by only one instructor	8

TABLE 2E

FREQUENCY TABLE OF TERMS AND PHRASES FOR USE OF CONTROLS (STABILIZER)

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
stabilizer	7	4	6	31	48
stabilize			1		1
trim your ship				1	1
nose heavy	1	4	6	4	15
nose light		11		1	12
tail heavy	2				2
tail light		1			1
Total	10	20	13	37	80
No. Terms Used	3	4	3	4	

Number of terms in the category	7
Number of terms used by all four instructors	2
Number of terms used by only one instructor	4

Table 20

FREQUENCY TABLE OF TERMS AND PHRASES FOR USE OF CONTROLS (RUDDER)

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
rudder	89	86	46	120	321
rudder pedals	11	1	25	4	41
right rudder	21	13	13	37	84
right pedal			1		1
"right one"			1		1
full right rudder			4		4
left rudder	10	9	12	4	35
full left rudder			2		2
rudder controls		1			1
straighten rudder		1			1
straight with rudder		1			1
neutralize rudder controls			4		4
"middle the rudder"				1	1
work rudder		5	3		8
kick on the rudders	1				1
kick full rudder	6				6
kick her into it			1		1
full rudder			1	13	14
forward rudder			1		1
opposite rudder	2	2	1	2	7
Total	120	119	115	181	535
No. Terms Used	7	9	14	7	

Number of terms in the category 20
Number of terms used by all four instructors 5
Number of terms used by only one instructor 13

TABLE 27

FREQUENCY TABLE OF TERMS AND PHRASES FOR USE OF CONTROLS (STICK)

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
aileron	24		7	37	68
aileron controls				2	2
center stick			2		2
elevator controls				1	1
neutral stick	4				4
forward of neutral			1		1
pull it			1		1
stick	125	212	239	78	654
heavy stick				1	1
pumping the stick		5			5
right aileron	2		1		3
right stick		7			7
left aileron	1		6	2	9
left stick		5			5
opposite aileron			1	2	3
opposite stick		1			1
Total	156	228	258	123	765
No. Terms Used	5	5	8	7	

Number of terms in the category	16
Number of terms used by all four instructors	1
Number of terms used by only one instructor	11

TABLE 28

FREQUENCY TABLE OF TERMS AND PHRASES FOR MOTOR AND OPERATION OF MOTOR

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
motor		9			9
horsepower		2		2	4
power	9	1	4	9	23
clean motor out		6		11	17
clear your motor			3		3
clogging up		1			1
loaded up motor		1			1
missing motor		2			2
motor cuts out				3	3
motor failure		1			1
motor trouble		1			1
Total	9	24	7	25	65
No. Terms Used	1	9	2	4	

Number of terms in the category	11
Number of terms used by all four instructors	1
Number of terms used by only one instructor	8

TABLE 29

FREQUENCY TABLE OF TERMS AND PHRASES FOR MOTOR ACCESSORIES AND PARTS

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
cabin heater			1		1
carburator	1		2	1	4
carburator heater	1		1		2
choke			1		1
cylinders			1		1
gas guage		1			1
gas tank	2				2
gas shut off valve			1	1	2
tachometer	7	1	1		9
oil pressure	4	10	2		16
oil temperature	4	10	2		16
Total	19	22	12	2	55
No. Terms Used	6	4	9	2	

Number of terms in the category	11
Number of terms used by all four instructors	0
Number of terms used by only one instructor	5

TABLE 30

FREQUENCY TABLE OF TERMS AND PHRASES FOR SWITCH

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
switch			1	1	2
switch on				2	2
contact	1	2	1	3	7
engine on			1		1
switch off		1		2	3
kick out motor		1			1
cut out motor		1	1	5	7
cut the switch				3	3
turn it off			1		1
throw gun off		1			1
motor cut off				3	3
shut off motor		1		1	2
Total	1	7	5	20	33
No. Terms Used	1	6	5	8	

Number of terms in the category	12
Number of terms used by all four instructors	1
Number of terms used by only one instructor	7

TABLE 31

FREQUENCY TABLE OF TERMS AND PHRASES FOR THROTTLE AND THROTTLE ADJUSTMENT

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
throttle	52	10	43	29	134
gun	4		1		5
idle				6	6
idling		1			1
idling speed		6			6
constant throttle setting			1	1	2
motor speed		7			7
tachometer reading	1				1
R.P.M.		13	18	2	34
revolutions		2			2
Total	57	39	64	38	198
No. Terms Used	3	6	4	4	

Number of terms in the category	10
Number of terms used by all four instructors	1
Number of terms used by only one instructor	6

TABLE 32

FREQUENCY TABLE OF TERMS AND PHRASES FOR INCREASING POWER

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
gun it	7	4	2	1	14
give her the gun		2			2
crack the throttle		1			1
cock the throttle	1				1
kick your throttle	1				1
open the throttle		9	2	17	28
throw her wide open			1		1
"wide open"	1		19		20
open her up			1		1
open it up			1		1
open motor	1	11			12
open motor up			1		1
open motor wide		10		8	18
push motor on		1			1
Total	11	38	27	26	102
No. Terms Used	5	7	7	5	

Number of terms in the category	14
Number of terms used by all four instructors	1
Number of terms used by only one instructor	9

TABLE 38

FREQUENCY TABLE OF TERMS AND PHRASES FOR DECREASING POWER

Term or Phrase	Frequency For Each Instructor				Frequency For All Instructors
	A	B	C	D	
cut motor	2	45	5	4	56
cut motor back		25	5		30
cut it down			1		1
close throttle			23	20	43
cut the throttle	1		9		10
ease throttle back			1		1
pull throttle	2		4		6
throttle back	2		2	13	17
throttle it down	6			1	7
throttle the engine				1	1
throttle the motor	1				1
pull off throttle	1				1
throttle off				1	1
close motor		1			1
reduce motor		3			3
reduce motor speed		16			16
power back			1		1
pull motor off	2				2
idle back	1				1
Total	18	90	51	40	199
No. Terms Used	9	5	9	6	

Number of terms in the category	19
Number of terms used by all four instructors	1
Number of terms used by only one instructor	12

APPENDIX B

A TRANSCRIBED SAMPLE OF FLIGHT INSTRUCTION

Presented in the following pages is a sample of flight instruction transcribed from the recordings made during the study covered in this report.

A TRANSCRIBED SAMPLE OF FLIGHT INSTRUCTION

Lesson 4
Student 5
Instructor D
March 10, 1941

I: O. K., then.

S: Boy, this head thing seems to have grown.

I: You let the door down there. I said, let the door down.....I'm going to let you do all the taxiing today.

S: O. K.

I: O. K., turn to the right. You noticed which way the wind is blowing, I hope.

S: It's going right towards that back.....

I: The wind is right out of the north so we'll taxi down to the (south.) Now, remember, taxi slowly, keep your eyes open and don't forget that S pattern in taxiing and leave the stick in neutral. ------ Now, use your throttle smoothly, don't hurry it....It's about time for another turn. Now when you have turned, look out both sides and check up on your traffic. ---------and the airplane comes to a complete stop; now we want to keep rolling, so we keep going for about 100 feet in the field.

S: 100?

I: Now, inasmuch as there is a lot of traffic using the airport from the left, we know there is someone somewhere around on our right here. Therefore, just in case someone is making a (180°side approach) landing, instead of turning to the left here, we will turn around to the right, scanning the ground and the sky at the same time.

S: That was to the right?

I: To the right....Now you can see if anyone was coming in you could see him.....Now if they were making a (180°approach), coming out on the first leg, you would give him the right of way.....All right now, I want you to make the take-off, ...from a full stop.....Use your throttle slowly ....Now come forward just a little bit after the airplane starts rolling .....Lower your nose down...to a gentle climb....and hold your nose in that position by applying back pressure...Now as you come back on the stick you are going to notice...that there will be a resistance to the

backward movement of it....after the airplane picks up a little speed ...and as soon as you feel that resistance you want to apply your back pressure, just enough to hold that nose--in a manner like that--to hold it in a normal climb. Don't let it down.

S: I see.

I: And then as soon as you break ground and start flying, use your rudder and aileron to keep your airplane level...but do not pull that nose up steep.....Hold it down just a little bit until (you pick up) flying speed, then resume your normal climb.

S: To start out is this in the right position?

I: O. K., this is right. Right straight ahead.

S: Right into the wind. I don't see any plane.

I: It is all yours....the open runways.....Wide open....Pull on the stick .....just a little. Now hold your nose in that position....Come on back....come on back...Hold it back....Now level off a little....Now you'll pick up flying speed....Raise your nose just a little...That's right there...

S: I did not see that. It sure gets off the ground in a hurry. I say it is a good thing you don't have time to worry about it.

I: Now as soon as we get 200 feet, we'll let our throttle back about half.

S: Are we about 200 now?

I: Will you close your throttle about half way now?

S: Yeah, I got it. I --

I: I can't hear you, but am I talking too loud? --for you?

S: No that's fine.

I: Shake your head.

S: O. K.

I: I am talking too loud?

S: No.

I: O. K.....Now you have your nose just a little high now.

S: All right, I'll bring it down....I don't seem to be much good at flying for some reason today.

I: We are going up to do some "S" turns across the road...and we will turn around a point on the (ground) and I will show you why it is necessary to change your bank as you come up into the wind. Steepen it up as you go downwind...

S: Uh-huh.

I: Now, will you close your throttle just a little more....That is better, right there. Now make a climbing turn to the left...

S: Left.

I: It is not necessary to pull your nose any higher than you have it, at a normal climb.....In fact, you should lower it just a little...and hold a very shallow bank....Now there is the proper right bank..... notice where the horizon...cuts the leading edge of your wing....That is just about the right bank for a climbing turn.....Climbing turn requires a shallow bank, and a shallow bank...is harder to hold, therefore, you will have to use your aileron considerable to hold that bank constant....All right now, recover. All right....let's level off.....

S: Seems to be going rather rapidly today.

I: You are still climbing....Look out under your wing...You can tell by that....if you can't tell by the nose.

S: Yeah.

I: Now as we level off....we throttle back to cruising speed...which in this particular airplane seems to be just a little better than 2000... They have it marked right under the yellow--

S: I see that.

I: Now to keep from climbing, remember you must have the wing level or down...just a little bit...have the front end down just a little....

S: Yeah.

I: That is it...right there.....

S: Do we--

I: What is that?

S: Adjust that?

I: Now adjust the stabilizer so it will fly level now....just relax your stick, and if the (nose) falls down, bring it back.....Now you have to do it rather fast....That is it....That is it...and then get it so it will fly level...

S: Oh,....hit the rough spots now...

I: Now do you have the (ship leveled) off pretty good?

S: Let's see, I believe that is about right....

I: O. K. Now (while) we are going down (to our) practice (area) there is no point of wasting your flying time so we'll do some coordination maneuvers.....All they are, are turns.....link one bank to another without a break....and you must do that smoothly and....coordinate your controls ...You coordinate everything in this maneuver, your back pressure,..... you are relaxing the back pressure and applying your aileron pressure... and.....rudder. Every movement and control used smoothly....All right, ...we'll go to the right...and relax our rudder...and kick it back.... We go around in a normal turn.....Now we will go to the left....We will apply the pressure and hold it until we roll over in a left bank and slowly relax it...applying our back pressure to hold our nose up....All right now, you just take over and go right ahead....Remember to hold your nose level...and don't let your bank get too steep.....Suggest a little more rudder on the recovery.

S: A little more rudder on the recovery.....O. K.

I: ----------That is better...Now hold that pressure...Hold it, hold it, hold it, hold it. Now relax it. See you apply that pressure and hold it smoothly and firmly until you reach your desired bank....Then you bring the aileron to neutral and (then) smoothly apply the back pressure. Now I want you to do the same thing with just a little steeper bank.... Well, don't be afraid to apply that pressure....That's (it). Now remember to apply that back pressure.

S: Shall I--

I: I don't believe you are making it...the bank quite as steep as you can.... just hold this turn on around now....Hold it in that bank.

S: I was not watching the wings that time, I was watching the nose.

I: O. K. Now recover and work back towards the airport.

S: I wonder where the airport is....I see the smoke stacks over that other way...I see--I see something...wonder what that is...on the other side.

I: O. K., now go into a normal glide....Now do the same thing in a glide... Use your rudder...Don't forget your rudder....Don't forget your back pressure...Now go the other way.....O. K., now recover and glide level and then....and then open your throttle and then resume a climb....O. K. Open it up...All right, now make a climbing turn to the left, remember your shallow bank and don't throw your nose too high.

S: I get the hang all right.

I: You have your nose just a little high. That's better.....right there.

I: All right, now level off.

S: See, I was watching the wrong thing before....I had a mark on the...on the wing.

I: ----Now we went back far enough here....We are out of the way from all houses.....and there isn't any cattle....in the....so we will use that as a pylon to fly around.....over there, That is it...down there. See you never want to pick a pylon that is a barn or a house and then fly around--or fly too close to the house because it will disturb the people in there--and we (want to) be as courteous in the air as possible. Not only for the people on the ground, but for the other fellows flying around.

S: Yes.

I: ---and I am going to come up further this time....put it in a bank... and turn holding...right turn and bank constant. And I want you to notice...that we will not go in a perfect circle around that barn as we would if the air were perfectly calm...Well, we have our bank established...have a given amount of back pressure and hold that bank constant ....Now you can see as we come around on the north side of it we are being blown in towards that barn.....Now when we come (on) out, it will be impossible to go around that barn perfectly even, because the wind is blowing us back.

S: Yes.

I: Now we will hold this turn...until we are headed back again....This time in all probability we will come in this side of the barn because the wind has blown us back...

S: Yeah.

I: Now, we are holding the same turn and the same bank....but now we are going right over the top of the barn instead of around the north of it, aren't we?

S: Yeah.

I: Now...We'll go down just a little lower...so that (it) will be brought out clear to you....Now this time I'm going around, but I am going to alter the bank....to take care of that....Now we are headed downwind... so we will steepen that bank up, but for a short turn...Now you notice the pylon is staying at one point..isn't it?

S: Yeah.

I: Now....we will hold it just a little steeper....Now we know the wind is out of the north...and we are heading up into it...just a little .....Therefore, we will shallow off slowly and smoothly.....All the way around...We are the first side down...You notice we are trying to cut shallower?

S: Yeah.

I: That barn is still there, right in the center.... Now as we start downwind again we will steepen that up. Notice that the barn still stayed right there. Therefore, we can fly around any object on the ground.... by controlling our banks...Now you continue on around there and hold that barn right in the center of our turn....Now you will have to shallow off just a little now....Just hold your (turn) but shallow off just a little more, you are coming up right side to the wind now.....Now just hold it...Now smoothly and slowly increase your bank...because you are going downwind. Now you will notice..the variation will hold that barn right where you want it...don't you?...by shallowing off the bank and increasing it....All right, now we are going to pick out a road going east and west and there doesn't seem to be any handy so we will just use that fence line right there by the barn.

S: O. K.

I: Now we will make S curves across that....having the same size loop on each side of the road. You notice we are turning into the wind, so we will start with a shallow bank.....And now as we come on downwind.... we increase our bank just a little...We'll notice that our path over the ground is (the loop end of an "8"). Really in the air it isn't, but our pattern is on the ground--that is the one we want....Now we have crossed the road at right angles...we are going downwind so we try to come back....make a (steep) bank.....shallowing off as we come around up into the wind. Now you will notice that the arch on this side of the...fence..is just the same as it was on the other....and, of course, it is about the same distance....Now I want you to take over, concentrate on holding that same pattern (all the way) down the fence line...also on maintaining a constant altitude.....Now let's start our turn to the right....remember shallow as you (go into) the wind.

S: I think I am looking at the wrong--

I: Now don't let the wind pull you over there....That's the time...Now keep it up a bit.....we are coming down....Now as you steepen your bank...don't forget to increase your back pressure....Now recover..... You cross it at right angles.....Now start (with a steep bank,) and as you come around, gradually shallow off....so your arch on this side will be the same as the other.

S: Golly jocker....I don't see the deck....

I: ——and cross your fence line at right angles each time....now level off. All right, now let's see you make a couple of them without me telling you....

S: All right...This is—

I: Seems like a pretty small arch on this side....You made your bank too steep....Now we will steepen it up so we will cross at right angles ....Now you are going downwind....make a steep bank....That is about it...Now you are no longer downwind.....Now you are starting to come up into the wind....Therefore, we start shallowing off....smoothly and slowly.....Now just hold that bank....and see if we don't cross that fence at about the right spot.....Now don't let it get too steep...

S: My nose is up.

I: Now you see your pattern this time is much better. Now steepen up a little as you are going downwind. That is plenty, now hold it. Now I've got a spot picked out where you should (cross) the next time.... I'm not going to tell you how to turn and see if you will do it right.

S: I am off the line.

I: Well, you made your loop on this side a little bit of a hairpin, therefore, you were quite short of the spot I had picked out just below.... Now you should have shallowed off as you come up into the wind.

S: I think I can't tell when I am in the wind.

I: I'll set the ship for you and start you out again.....Now I have another point.....Let's see if you can come up to it this time...about where that field joins over there....see....Remember you come up into the wind and shallow off a little now...

S: I believe I can fly better.

I: Just hold it...Now you see we are going directly over the point we had picked out....Well,.....Very nicely there.....All right.....Now let's (fly) back towards the airport.....I want you to put it in a (slight climb)....and do that coordination exercise while you are (climbing) ....Remember the throttle.....Don't forget the back pressure....Now roll her right on over.....holding your nose up.....I believe you can hold your nose just a little bit higher....That's good right there.....You are flying without a pressure one time and then flying with one another .....—busts up the angle—

S: Yeah, I don't particularly like it very much.

I: All right, now back to the right....Now hold your nose up just a little

higher....That's it.....Now I believe we should hold just a little shallow bank....shallow that off.....Remember

S: ....is that O. K.?

I: Remember my demonstration here last time...you flew...a constant bank and a constant back pressure...

S: Yeah.

I: Do that and---your nose will go right where you want it?

S: Yeah.

I: We put on a certain amount of back pressure----and hold her nose right where we want it...regulate the (turn) by the bank.. ..Now we are considerable higher than we were, so that is good proof that we kept turning and climbing at the same time, isn't it?

S: Yeah..

I: Well, we might want to lose a little of this altitude.....let's make a normal turn to the right....in a glide now...don't forget your back pressure...recover.....now make a turn to the left. Don't forget to use your rudder along with your aileron.....Now you are letting your nose creep back up on you...

S: Yeah....forget that pressure..

I: Now, if you will look around....We look out on the one wing tip....let our gaze wander right over the horizon....and (to) the nose around to the other wing tip....and at the same time we want to notice the field .....the weather condition....and with your gaze sweeping from one side of the plane to the other....You will see airplanes and also other things you wouldn't see if you were to stare ahead or to one side.... of the plane.

S: Yeah.

I: You always want to look around and observe what is going on. Now hold that normal glide.....Swing left to make this landing...I've told you how to make them, haven't I?

S: Yeah....

I: Once you start back on that stick don't come forward.....unless your nose gets too high....then merely relax your stick. Don't shove it down....By all means get relaxed....don't be cramped on a landing.... Keep your nose straight ahead.....You may have to open the throttle and take off.....Now, slowly come back. Just keep on coming back slowly and smoothly and don't let the airplane touch the ground. Come on

back, on back. Hold her back. Hold it. Keep your nose straight. You haven't made your landing yet till it stops rolling.....That wasn't a bad landing.....Let's taxi up to the line, now....Now, don't forget your S pattern here. As we approach those other airplanes down there, remember to use caution. Also bear in mind that we don't have any (brakes) on these. The only way we can stop it is to close the throttle, because we don't want to get too much speed .....Does that throttle work stiff or are you hanging on to it real tight?

S: I think we're not working together on it, maybe that's it.

I: Let's turn around. It looks like Waco wants to come out so we'll gain a little room. We'll try to pull up there close to the concrete.

S: Yes. Kind of muddy right here.

I: Yes, it's kind of bad.....Now, let's pull up on the cement.