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PROGRAMED INSTRUCTION
IN CLARINET PEDAGOGY:
A FEASIBILITY STUDY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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* * * * * *

The Ohio State University
1972

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ACKNOWLEDGMENTS

Sincere appreciation is expressed to the directing professor of this dissertation, Dr. Henry L. Cady, for his supportive counsel and scholarly advice. Gratitude is also expressed to Dr. Harold Luce for his helpful suggestions and to Dr. A. Peter Costanza for his guidance in areas of statistical design.

Professors Jack Evans, Donald McGinnis, Robert Titus and George Wilson provided expertise in matters of pedagogy.

The author particularly wishes to express appreciation to his wife Susan, not only for her encouragement and support, but for her creative work in designing and preparing the many illustrations in the programed text.

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CHAPTER I

INTRODUCTION

An area of instruction variously entitled "minor performance instruments" or "elementary instrumental methods" commonly exists in the curricula of accredited teacher education institutions. A search of course offerings reveals a variety of requirements, teaching methods, and content. But questions concerning the objectives of the college minor performance instrument classes, logical organization of content, effective method of presentation, and efficient use of student and teacher time have received little attention from researchers in the profession.

Deihl states that although teachers are theoretically qualified to teach all the orchestral instruments, few can demonstrate them all.[1]

> It is the rare band director-clarinetist, for example, who can produce a true tone quality on all the woodwind instruments, let alone the brasses, although he may know the fingerings and basic principles of embouchure for all the instruments. This observation is not surprising, however, considering the limited amount of time

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[1]Ned C. Deihl, Development and Evaluation of Computer-Assisted Instruction in Instrumental Music, Project No. 7-0760, Office of Education, U.S. Department of Health, Education, and Welfare (Washington, D.C., 1969), p. 3.

> that can be devoted to applied secondary instruments in the teacher preparatory curriculum.[2]

Prior to 1965, the National Association of Schools of Music (NASM) recommended a minimum preparation of one instrument in each minor instrument area, e.g., the equivalent of one term or semester of clarinet as a minimum recommendation in the woodwind minor performance area. The current NASM By-Laws and Regulations read as follows:

> Music students generally enter vocational preparation with some performing ability in one, two or possibly three fields. Skill in at least one of these should be developed to the utmost level through private instruction, solo performance, ensemble participation and intensive practice. Such competence is essential for artistic music teaching and contributes greatly to the teaching of those fields related to the needs of the prospective band, orchestra or choral teacher. The foundations of technique in these latter fields may be acquired through private or class instruction. (Italics mine.)
>
> Similarly, the future music teacher needs to participate throughout this period in the ensemble of his choice, but should have opportunity also to acquaint himself with the special literature and techniques of other types of musical organizations. The mature student deserves the opportunity to observe and participate in the operation and conducting of such organizations.[3]

The recommended preparation in minor instruments for this area is stated as "Class or private instruction in

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[2] Ibid.

[3] Carl M. Neumeyer, ed., National Association of Schools of Music: By-Laws and Regulations (Washington, D.C.: National Association of Schools of Music, 1965, pp. 28-29.

appropriate secondary fields." Such a vague statement would appear to insure even less adequate preparation to teach all of the woodwind instruments than the recommendations written prior to 1965.

Goetzmann[4] compared the course offerings and requirements of ninety member institutions with the NASM minimum recommendations, and found that teacher training in the minor performance area was shown to be frequently inadequate. There was a notable lack of instruction in instruments other than violin, clarinet, and trumpet. More than one class in each choir of instruments was seldom required by the ninety institutions responding to his questionnaire.[5] The classes were further reported to be organized in various homogeneous and heterogeneous groupings.

In a heterogeneous woodwind class, the student, while attempting to cope with the problems of playing his own instrument, is often expected to form relationships and to retain concepts pertinent to the other instruments being played. These relationships may seem patently logical and reasonable to the woodwind major or to the instructor, but not to the keyboard or voice student. Mid-term and final

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[4]Edward C. Goetzmann, "An Investigation of Specific Factors Related to Minor Performance Area Classes in Music Education Curricula" (unpublished doctoral dissertation, Teachers College, Columbia University, 1962), in "Digest of the Study," p. 2.

[5]Ibid., p. 154.

examinations reveal that complex understandings are not always reliably formed in a casual learning environment, that is, an environment in which the student's ability and motivation to cope with the content and method of presentation is taken for granted.

In studying staffing problems of the small college music department, Tipton[6] concluded that unusual teaching combinations needed by small departments sometimes create unsolvable staffing problems. Allvin[7] stated that music departments faced with skyrocketing costs have responded with larger classes, more lectures, less student-professor interaction, and lowering of skill objectives. "Efforts to counteract the trend toward mass education have had some good results--notably in the use of programed instruction materials."[8]

The necessity to teach minor instruments more efficiently was felt by Woelflin, one of the early investigators to use a teaching machine to program specific material for instrumental music teaching. He writes that

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[6]Chelsea Tipton, "Problems in Curriculum Design for Teacher Education in the Small College Music Department," Reviewed by David Swanzy, Council for Research in Music Education, Bulletin No. 18 (Fall, 1969), 48.

[7]R. L. Allvin, "Do Colleges and Universities Need an Automated Music Learning Center?" Council for Research in Music Education, Bulletin No. 21 (Summer, 1970), 32.

[8]Ibid.

a principal purpose of his study was to devise a means of conserving the classroom time of the instrumental music teacher.[9]

Although no research could be found to support the assumption that one can teach an instrument better if he is able to perform upon it, the NASM recommendations appear to support that viewpoint. Apparently for the same reason, Lee also recommends class and ensemble experience in which the student develops skills in the use of minor performance instruments.[10]

Wilson, on the other hand, recommends that minor instrument and voice classes should place more emphasis on methods of teaching children--not on growth of performance skills for the university student.[11]

> Data revealed that students received proportionately more skill in singing and playing instruments than in teaching others how to develop them.

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[9]Leslie Edward Woelflin, "An Experimental Study on the Teaching of Clarinet Fingerings with Teaching Machines" (unpublished doctoral dissertation, Southern Illinois University, 1961), p. 3.

[10]C. Loran Lee, "Developing Patterns of the Undergraduate Music Education Curriculum in the United States," Missouri Journal of Research in Music Education, I (Autumn, 1966), 84.

[11]George Hugh Wilson, "A Study of Professional Music Education at The Ohio State University" (unpublished doctoral dissertation, The Ohio State University, 1958), pp. 274, 278.

> Experiences during voice classes and minor instrument classes could be presented in terms of teaching others.[12]

It appears, however, that in spite of the wide variety of course organizations, contents, and methods, professional teaching success as an instrumental music teacher may be related to the grade the individual student received as a student in the minor performance class. Borkowski found that although little relationship existed between the quality of work done in undergraduate courses in music education and professional teaching success, the quality of work in minor performance instruments was related to success in teaching as measured by experts.[13]

Bigham states:

> The Elementary Wind Methods class at Florida State University is required of all music education majors. This means that many of the instrumental majors have a thorough background in woodwind fingerings while some vocal majors have never held an instrument in their hands. If the topic is presented by lecture, it is impossible to gear it to the needs and levels of the entire class because of the wide diversity of individual backgrounds. There is a need for material which can be used individually at a time best suited to the student and with which the student can proceed

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[12] Ibid., p. 274.

[13] Francis Thomas Borkowski, "The Relationship of Quality of Work in Undergraduate Music Curricula to Effectiveness of Instrumental Music Teaching in the Public Schools" (unpublished doctoral dissertation, West Virginia University, 1967), p. 81.

> at a pace commensurate with his background. Programmed material seems to be the best solution.[14]

The teacher of the woodwind methods class may or may not possess a woodwind background, may or may not be a specialist on each of the woodwinds, but he is certainly faced with the following questions notwithstanding his particular performance skill and understanding:

1. What are the basic woodwind concepts with which the prospective teacher cannot do without?
2. How can these concepts most effectively be learned by students of diverse backgrounds and interests?
3. What is the best way to insure that students are actively involved in relevant learning activities?
4. How can one deal with both pedagogical and performance skills in the minor performance class?

It would seem that such problems as logical organization of content, effective method of presentation, and efficient use of student and teacher time could be met successfully through the approach of programed instruction. Programed instruction provides such advantages as: (1) objective specification and logical organization of content; (2) active participation through immediate feedback to self-correct or to reinforce; and (3) self-paced student

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[14]William Marvin Bigham, Jr., "A Comparison of Two Response Modes in Learning Woodwind Fingerings by Programmed Text" (unpublished doctoral dissertation, Florida State University, 1965), p. 10.

learning which is less dependent upon the skill, knowledge, and available time of the instructor. Applying these to the combined content of pedagogy and performance skills would seem to be advantageous in minor instrument instruction.

Purpose of the Study

The purpose of this study was to determine the feasibility of developing programed instruction in the methods of teaching beginning clarinet players. The study sought:

1. To identify a body of knowledge concerning clarinet pedagogy appropriate to the prospective instrumental music teacher.
2. To develop instruction in clarinet pedagogy utilizing programed instruction techniques appropriate to college music education students.
3. To evaluate the effectiveness of a program of instruction in clarinet pedagogy for college music education students.

Questions

Specifically, the study sought to answer the following questions:

1. Can a program of instruction be developed which will effectively teach a content of clarinet pedagogy?

2. Will the knowledge of clarinet pedagogy, as measured by a criterion test, be significantly increased through the utilization of a program of instruction?

Definitions

Clarinet Pedagogy refers to instruction in the methods of teaching beginning clarinet players.

Learning, as the term is used in this study, refers to only those changes in behavior that are brought about by experience with the program developed for the study.

Program refers to a device to control a student's behavior and to help him learn without the supervision of a teacher.

Programed Instruction, for purposes of this study, is the organization of units of material, logically sequenced, and providing for active participation, immediate feedback, and self-pacing.

Limitations

This study was limited to determining the feasibility of constructing a program by which principles of clarinet pedagogy may be learned. Experts in the field of instrumental music education assisted the writer in determining the basic content to be programed.

A criterion test, devised to measure knowledge of clarinet pedagogy, was administered as a pretest-posttest. An analysis of the difference between these scores

determined the effectiveness of the program. The study was not concerned with a comparison of the effectiveness of programed instruction with any other type of instruction.

Excluded from this study was any attempt to measure such variables as readiness, motivation, or factors connected with the transfer of training to motor skills.

The design of the study restricted extra-program learning in an effort to assess only that learning which resulted from use of the program of instruction.

CHAPTER II

RELATED LITERATURE

Introduction

The first part of this chapter examines the elements and types of programed learning which have a bearing upon the construction and development of the Programed Text in Clarinet Pedagogy and upon the design of the study. The second part describes research studies related to programed learning in instrumental music.

Programed Learning

Efforts to define programed instruction often result in descriptions of styles, approaches, methodologies, or features which characteristically divide into types or techniques commonly associated with a particular founder or leading exponent.

Vander Ark states that "programs usually are divided into two types--linear and multiple-choice,"[1] but these are

[1]Sherman D. Vander Ark, "Programed Instruction in Twentieth Century Music: A Feasibility Study" (unpublished doctoral dissertation, The Ohio State University, 1970), p. 11.

not equivalent terms. The term "linear"[2] refers to the presentation of information in a fixed sequence, whereas "multiple-choice"[3] is a response mode in which the learner selects from two or more alternatives. Vander Ark thus further defines linear programing as "associated primarily with Skinner and . . . is known also as 'constructed response,' or 'small step' programing."[4]

Klaus,[5] seeking to clarify the categorization of programing techniques, views specific programing techniques as reflecting the programer's general conceptual position with regard to existing theories of learning.[6] For purposes of trying to overcome anticipated learner difficulties, the programer tends to concentrate on variables consistent with his general conceptual bias. The approach of connectionist oriented programers tends to be response-

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[2]Edward F. O'Day et al., Programmed Instruction: Techniques and Trends (New York: Appleton-Century-Crofts, Meredith Corporation, 1971), pp. 198-99.

[3]Ibid., p. 196.

[4]Vander Ark, op. cit., pp. 11-12.

[5]David J. Klaus, "An Analysis of Programing Techniques," in Teaching Machines and Programed Learning, II: Data and Directions, Robert Glaser, ed. (Washington, D.C.: National Education Association, 1965), pp. 118-23.

[6]The reader is referred to summaries of the major learning theories and to an alternative view of learning in: Robert M. Gagné, The Conditions of Learning (New York: Holt, Rinehart and Winston, Inc., 1965), pp. 3-61.

centered, whereas the configurationist reflects a stimulus-centered approach.

The connectionist believes that "learning occurs gradually as the probability of certain responses is increased through repeated instances in which a reinforcement or reward follows the occurrence of the response."[7] Conditions for learning require opportunities for reinforcement, active performance of the desired response, and enough practice in responding to insure permanence of learning.

> . . . to improve the quality of a response, reinforcement is applied differentially to gradually "shape" the response to the desired degree of proficiency. Motivation is regarded as those conditions which permit reinforcement, e.g., water deprivation will permit the use of water as a reinforcement. There need be no logical relationship between the kind of response being strengthened and the kind of reinforcement used; . . . . Most connectionist theorists feel the learning process is mechanistic; . . . all that is required to promote response acquisition is a responding organism which is properly reinforced when instances of the desired behavior occur.[8]

The configurationist considers learning to be a cognitive phenomena consisting of a formation of associations which are a result of the organization of perceived stimuli in the learner's environment. The learner's previous experience and capabilities and the characteristics

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[7]Klaus, op. cit., p. 123.

[8]Ibid., p. 124.

of the stimuli determine the associations formed.[9]

> Performance is not essential to learning; rather, it is a product of learning in the sense that learning permits goal-directed, problem-solving behavior to occur under the proper motivating conditions. Learning itself occurs when perceived stimuli become related to each other . . . in order to insure that the desired learning will occur, the learner's attention must be directed at the relevant aspects of his environment, and these must be arranged in such a way as to facilitate the formation of new cognitive relationships. Insight and ideation are important determiners of post-learning performance and must therefore be promoted by the instructional process.[10]

B. F. Skinner is generally recognized as the founder of the response-centered programing movement. With an extensive background in research on operant conditioning, Skinner, in 1954, proposed the application of his laboratory findings to the field of teaching.[11] He devised learning strategies which resulted in a teaching machine incorporating these principle features:

1. A linear arrangement of small, carefully graded steps.
2. The use of formal and thematic prompts.

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[9] Ibid.

[10] Ibid.

[11] B. F. Skinner, "The Science of Learning and the Art of Teaching," in Teaching Machines and Programmed Learning: A Source Book, A. A. Lumsdaine and Robert Glaser, eds. (Washington, D.C.: National Education Association, 1960), pp. 99-113.

3. Active participation (overt responding) and self-pacing.
4. A constructed response answer mode.
5. Immediate knowledge of results.
6. A self-correcting system through revision of frames based upon student errors.

All students follow the same linear arrangement of small, successive frames of information and questions which, when combined with prompting, virtually insures that learners will emit a correct response which can then be reinforced for purposes of retention and shaping of behavior. A low error rate of from five to ten per cent is maintained because wrong answers strengthen unwanted responses. Active practice is provided by the overt responding mode. A constructed response is necessary to insure recall rather than recognition--"to make a response as well as see that it is right."[12]

The configurationist position is expressed by N. A. Crowder who postulates that "the basic learning takes place by an unanalyzed process during the student's exposure to written, or, in general, symbolic material."[13] He contends

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[12]B. F. Skinner, "Teaching Machines," Scientific American (November, 1961), 90-102 as cited in Klaus, op. cit., p. 128.

[13]Norman A. Crowder, "Intrinsic Programing: Facts, Fallacies, and Future," in Prospectives in Programing, Robert T. Filep, ed. (New York: The Macmillan Company, 1963), p. 89.

that more use can be made of an incorrect response which occurs not by chance, but because the student was misguided in his thinking. The major differences in format between Crowder's branching programs and Skinner's linear programs include:

1. Larger step size
2. Multiple-choice questions
3. Branching remedial frames

In Crowder's method, a paragraph or more of information provides the learner with meaningful information with which he may interact to form new relationships. Because learning is considered to have occurred before the response, an overt constructed response is neither necessary for reinforcement purposes nor for insuring practice. "The test result is used to control the next material the student sees, either advancing the student or supplying remedial material as indicated."[14]

> Ordinarily the question should not be one that the student can answer directly from the material on the page without at least combining two facts, perhaps, or going through some fairly complicated reasoning process to figure out the answer.[15]

Although Pipe[16] criticizes the dull exposition that

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[14] Ibid.

[15] Ibid., p. 106.

[16] Peter Pipe, Practical Programming (New York: Holt, Rinehart and Winston, Inc., 1966), p. 12.

may result from small step writing in linear programs, he also points to an inherent weakness in many programs written in Crowder's format: "Before the programmer can be sure that he has communicated all that he intended, he must (1) ask the right question, and (2) supply the right responses."[17]

In order to control learning, the stimulus-centered programer directs his efforts at improving the quality of the stimulus presentation.

> To accomplish this, the material to be learned is organized and structured in a logical and familiar context with particular concern for the intensity, coherence, and meaningfulness of new information. Because his goal is intelligent learning, the stimulus-centered programer is likely to provide the learner with a clear sense of purpose and direction. He is apt to avoid fragmenting material into steps so small that the main ideas are lost and the development of creative insights is made difficult or impossible. The composition of the program is designed to encourage cognitive mediation, to make the learner think about what is being taught so that the new relationships necessary for proficiency can be acquired. The learner's motivation is an important concern of the stimulus-centered programer, and therefore he takes special pains to give the learner a clear understanding of his progress and the usefulness of his accomplishments.[18]

Variations on the above techniques have been advanced by T. F. Gilbert and others. The basic assumption in Gilbert's system of "Mathetics" is the motivation to perform

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[17] Ibid., p. 13.

[18] Klaus, op. cit., p. 126.

like a master of the subject will keep students working at the program.[19] The program, therefore, is aimed at mastery performance, and seeks to offer the student something he values in return for his efforts.

> A mathetics programme begins life with a careful study of the mastery performance with a view to describing exactly what a master of the subject will attend to, what he will do, and what he will think or say to himself in order to do it. These three components are then subjected to a most rigorous examination to see if they are the best and most parsimonious set of teaching points. Very often the traditional skills can be shown to be unnecessarily cumbersome or inefficient.[20]

Because high motivation is often found at the end of an instructional sequence, the mathetics technique usually begins with an overview of the program. It identifies terminal behavior, and, by encouraging the student to finish sections by himself, seeks that behavior which is required after formal teaching has ended.

Task analysis is central to the mathetics technique. Gilbert writes:

> . . . a subject matter is a class of behaviors and . . . everyone has some behavior which approximates that behavior class. It is easy to forget that the behaviors one goes through to master the subject matter may be different from the actual subject matter behaviors. The-

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[19] Harry Kay, Bernard Dodd, and Max Sime, Teaching Machines and Programmed Instruction, Pelican Books (Baltimore: Penguin Books, Inc., 1968), pp. 50-52.

[20] Ibid., p. 52.

> failure to grasp fully the implications of this rule has been, in my experience, the biggest single stumbling block for people learning to program education. The natural tendency is to begin by breaking the subject matter down into small, concise units. While this is valuable for describing the repertory you wish to build, these behavior units usually are not the ones which will actually build that repertory. They are test items, not teaching guides.[21]

Both Gilbert and R. F. Mager[22] have suggested that the teacher's preconceived idea of content and learning sequences may interfere with student learning. Mager attempts to discover the student's frame of reference by giving a demonstration or lecture, calling for questions, and then pre-programing modules of instruction to deal with popular questions and sequences--the student, in a sense, controls the lesson. Mager reported a sixty-five per cent reduction in training time by giving students objectives for an industrial training course and permitting them to structure their own course of training.[23]

It is Mager's thesis that in order to effectively develop and to assess instructional sequences, one must be able to identify the specific terminal behavior expected of

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[21]Thomas F. Gilbert, "On the Relevance of Laboratory Investigation of Learning to Self-Instrucational Programming," in Teaching Machines and Programmed Learning: A Source Book, A. A. Lumsdaine and Robert Glaser, eds. (Washington, D.C.: National Education Association, 1960), pp. 478-79.

[22]Kay, op. cit., pp. 52-54.

[23]Pipe, op. cit., p. 16.

the student. To describe terminal behavior, one should:

1. Identify and name the over-all behavior act.
2. Define the important conditions under which the behavior is to occur (givens or restrictions, or both)
3. Define the criterion of acceptable performance.[24]

Stating instructional objectives in behavioral terms is central in determining what material should be learned, how it should be learned, and to what extent the student has learned it.

A review of recent literature reveals fewer restrictive preconceptions as to the use of the term "program." Seeking to encourage creativity and to avoid dogma, Lumsdaine has proposed a definition with a minimum of restrictive connotations and theoretical presuppositions:

> An instructional program is a vehicle which generates an essentially reproducible sequence of instructional events and accepts responsibility for efficiently accomplishing a specified change from a given range of initial competences or behavioral tendencies to a specified terminal range of competences or behavioral tendencies.[25]

This definition permits a variety of program formats and techniques to be combined for larger or smaller steps,

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[24]Robert F. Mager, Preparing Instructional Objectives (Palo Alto: Fearon Publisher, Inc., 1962), p. 53.

[25]A. A. Lumsdaine, "Assessing the Effectiveness of Instructional Programs," in Teaching Machines and Programed Learning, II: Data and Directions, Robert Glaser, ed. (Washington, D.C.: National Education Association, 1965), p. 288.

various response modes, combinations of linear and branching paths, fixed-pace group[26] and self-pacing, and the use of various media combinations.

O'Day[27] investigated the effectiveness and efficiency of nine different programed formats in a two-year study of nearly three thousand learners from a state college, three junior colleges, and a military installation. The experimental materials were primarily composed of associative learning tasks. The experimental design for all formats mandated principles of objective specification, self-pacing, and empirical testing; optional principles included overt responding, immediate feedback, and small-step size. The study also compared linear/branching/auto-elucidative[28] techniques, multiple-choice/constructed responses, high/low error rates, and prompting/confirmation techniques.

Results of the study, based upon posttest gain/program time, indicated support for principles of small steps,

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[26]Economic considerations might require a fixed-pace program for a classroom in which each student operates a small response unit while viewing one large screen on which the stimuli are presented.

[27]O'Day, op. cit.

[28]S. L. Pressey's auto-elucidative or "adjunct programing" technique consists of presenting up to a chapter of text, followed by multiple-choice questions to which the learner continues to respond until he responds correctly. Proponents see the test item in both testing and teaching roles, but no remedial branching or prompting is supplied. See O'Day, op. cit., pp. 8-11, 149-50.

the option to review the text prior to responding, and thematic prompting. Support was not found for branching remediation, constructed response, or the auto-elucidative techniques. Other recommendations included (1) irrelevant text information should be avoided, and (2) the numbers of distractors in multiple-choice questions should be kept at a minimum except in terminal stages of discrimination training.

Programed Learning in Instrumental Music

A review of the literature and published materials concerning programed learning in music reveals that the subject matter deals primarily with basic skills in areas of music theory, dictation, sight reading, and music appreciation.[29,30,31] The presentations typically combined a programed textbook with tapes, and were directed at the college student level.

No programed materials were discovered which attempted to teach a comprehensive knowledge of pedagogy for any

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[29]Leon Dallin, "Music Educators Should Get with the Program," Music Educators Journal, LV (March, 1969), 50-52.

[30]Sherman D. Vander Ark, "Bibliography of Materials on Programed Instruction in Music" (unpublished paper, The Ohio State University, 1969), pp. 2-10.

[31]Kirby Rogers and Frank Almond, "A Bibliography of Materials on Programed Instruction in Music," Journal of Research in Music Education, XVIII (Summer, 1970), 178-83.

woodwind instrument. Six studies are reported below which deal with aspects of performance in instrumental music.

Woelflin[32] was one of the first investigators to program specific material for instrumental teaching. He developed a teaching machine program which was designed to teach beginning clarinetists the fingerings, nomenclature of the parts and keys, and the names of the different ranges of the clarinet. A principal purpose of the study was to devise a means of conserving the classroom time of the instrumental music teacher.

Woelflin designed a comparative study which included two days per week instruction by each of three groups:

Group I (regular classroom instruction)

Group II (used teaching machine, held clarinet, but did not play)

Group III (used teaching machine, and encouraged to to play)

The three groups also combined two days per week to work on individual problems and ensemble playing. No significant difference in performance or knowledge was found between the three groups. No provision was made in the experimental design to restrict the contaminating influence of

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[32]Leslie Edward Woelflin, "An Experimental Study on the Teaching of Clarinet Fingerings with Teaching Machines" (unpublished doctoral dissertation, Southern Illinois University, 1961).

the instructor during the combined sessions.

Lumsdaine states:

> Even though the contemplated later use of the program may actually be in conjunction with other instruction, it can be contended that relatively unambiguous information about what it can accomplish by itself, without supplementation, is more useful than uninterpretable information about gains produced by some unknown mixture of program effects and other unspecified influences.[33]

Three programed texts[34,35,36] were developed at Florida State University for minor performance classes, two of which, the Jensen and Bigham texts, are similar in format and design.

The purposes of Bigham's study were: (1) to develop a program for teaching principles and applications of woodwind fingerings to the college methods class, and (2) to compare two modes of response employed in the experimental study. The bulk of the program dealt primarily with flute and clarinet fingerings, as did the pretest and

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[33]Lumsdaine, "Assessing the Effectiveness," p. 297.

[34]Dale K. Jensen, "Valve and Slide Positions in Brass Instruments: A Programmed Text" (unpublished Master's thesis, Florida State University, 1962).

[35]William Marvin Bigham, Jr., "A Comparison of Two Response Modes in Learning Woodwind Fingerings by Programmed Text" (unpublished doctoral dissertation, Florida State University, 1965).

[36]Neal O'Neal, "The Development of a Concept of String Techniques by a Programmed Course of Instruction for the Heterogeneous String Methods Class" (unpublished doctoral dissertation, Florida State University, 1968).

posttest exclusively. The pretest format consisted of marking diagrams, the posttest required fingerings to be reproduced on the instruments. While taking the program, one group made responses by marking diagrams, the other was furnished with instruments in order to actually finger the note. It was concluded that the motor response method was superior for those who had no prior woodwind experience.

The purpose of O'Neal's study was to develop a Skinnerian type program dealing with five aspects of string techniques: nomenclature, posture, tone production, bowings, and fingerings, which would provide the student a concept of basic performance techniques of the violin, viola, 'cello, and double bass. The experimental design utilized three groups of sample populations:

Group I (subjects with string methods class experience only)

Group II (experienced string players)

Group III (subjects with no prior string instruction)

Differences were computed between pretest and posttest scores to assess significant gain in scores. O'Neal concluded that a concept of string techniques is not dependent upon prior study of string instruments, upon extent of prior study, nor upon extent of prior study of a specific string instrument.

LaBach[37] constructed a teaching machine by which a student may, in any of the three modes, play a predetermined exercise, hear a playback of his performance, and hear a prerecorded model performance. Programed material was prepared for trumpet and clarinet, the material emphasizing such problems as tone quality, rhythmic accuracy, phrasing, articulation, and style.

LaBach reports these advantages of the teaching machine: (1) very simple to operate (2) adaptable to various levels, instruments, and types of problems (3) lets the student hear himself (4) provides the student with a model performance for comparison purposes (5) helps the student to pace his own practicing (6) supplements the teacher's instruction, thereby saving teacher time, and teaches regardless of the teacher's level of competence.

Deihl[38] investigated the feasibility of computer-assisted instruction in instrumental music through the development and evaluation of a course in articulation, phrasing, and rhythm on the intermediate level for clarinet. An aural program emphasizing aural-visual

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[37]Parker LaBach, "A Device to Facilitate Learning of Basic Musical Skills," Council for Research in Music Education, Bulletin No. 4 (1965), 7-10.

[38]Ned C. Deihl, Development and Evaluation of Computer-Assisted Instruction in Instrumental Music, Project No. 7-0760, Office of Education, U.S. Department of Health, Education, and Welfare (Washington, D.C., 1969).

discrimination was combined with a playing-recording program utilizing pre-recorded models. Deihl concluded that computer-assisted instruction was well adapted for aural-visual discrimination training.

No programs were found which attempted to teach college music education majors how to teach beginning clarinet players. Throughout the literature there appears to be the implicit assumption that the gaining of instrumental performance skills is prerequisite to teaching the instrument, and no programed materials expressed the intent to directly teach college students a broad content of pedagogical knowledge.

CHAPTER III

PROCEDURES

Introduction

The study concerns the development and evaluation of programed instruction in clarinet pedagogy. This chapter describes the rationale underlying the experimental design, the developmental stages of the program, and procedures for evaluating the effectiveness of the Programed Textbook in Clarinet Pedagogy.

Experimental Design

Costanza[1] and Vander Ark[2] suggest that research design in programed instruction is becoming less concerned with comparing programed and "conventional" instruction. Lumsdaine also reports that, "The inherent weaknesses of such media-vs-media . . . comparisons have long been recognized as relatively unproductive in terms of any direct

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[1]A. Peter Costanza, "The Development and Evaluation of Programed Instruction in Score Reading Skills" (unpublished doctoral dissertation, The Pennsylvania State University, 1968), pp. 48-50.

[2]Sherman D. Vander Ark, "Programed Instruction in Twentieth Century Music: A Feasibility Study" (unpublished doctoral dissertation, The Ohio State University, 1970), pp. 13-14.

scientific contribution."[3] Silberman expresses support for exploratory research in the initial stages of programed instruction:

> It is to be expected that in the future the hypothesis-testing research model will give way to decision-theory models. Furthermore, the formal experiment will increasingly be preceded with a phase of exploratory research. . . . This is a process of trying out different methods of bringing about particular behaviors. Those ideas which seem to work are pursued and followed down any avenue. . . . Little attention is given at this stage to . . . procedures whereby different control-group comparisons are made. This type of research increases the likelihood of obtaining results which might have practical value for education.[4]

Supporting the desirability of feasibility studies, Lumsdaine notes: ". . . that until an effective method of teaching has been evolved by informal trial and error in a particular situation, comparison of specific factors may be conducted at such a low level of over-all efficiency that the influence of variables manipulated may be distorted."[5]

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[3]A. A. Lumsdaine, "Instruments and Media of Instruction," in Handbook of Research on Teaching, N. L. Gage, ed. (Chicago: Rand McNally & Company, 1963), p. 598.

[4]Harry F. Silberman, "Trends in Programed Instruction--an Improvement in Educational Technology," in Prospectives in Programing, Robert T. Filip, ed. (New York: The Macmillan Company, 1963), p. 145.

[5]Lumsdaine, "Instruments and Media," p. 663.

Initial decisions based upon the related literature were:

1. The study would be exploratory in nature. It would explore the feasibility of developing a program of instruction which could teach students how to teach.

2. The study would not compare programed instruction with any other form of instruction. A pretest-posttest design would determine the effectiveness of the program of instruction.

3. No extra-program instruction would be permitted to contaminate the pretest-posttest results. A future study would investigate the combining of program and classroom instruction for purposes of determining practical application.

Methodology

The following developmental stages were adapted from the procedures suggested by Green,[6] Mechner,[7] Markle,[8] Lysaught and Williams,[9] Espich and Williams,[10] and Pipe.[11]

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[6]Edward J. Green, "The Process of Instructional Programing," in Programed Instruction, The Sixty-sixth Yearbook of the National Society for the Study of Education, Part II, Phil C. Lange, ed. (Chicago: The University of Chicago Press, 1967).

[7]Francis Mechner, "Analysis and Instructional Sequencing," ibid.

[8]Susan M. Markle, "Empirical Testing of Programs," ibid.

[9]Jerome P. Lysaught and Clarence M. Williams, A Guide to Programmed Instruction (New York: John Wiley and Sons, Inc., 1963).

[10]James E. Espich and Bill Williams, Developing Programmed Instructional Materials: A Handbook for Program Writers (Palo Alto: Fearon Publishers, Inc., 1967).

[11]Peter Pipe, Practical Programming (New York: Holt, Rinehart and Winston, Inc., 1966).

1. A general statement was written defining the program.
2. The student population was specified.
3. The instructional objectives were defined in behavioral terms.
4. The prerequisite skills were defined in behavioral terms.
5. A criterion test was prepared; validation was obtained by subject matter specialists.
6. The program content was outlined.
7. The programing types and techniques were selected.
8. A single concept was programed and pilot tested.
9. The first draft of the program was constructed.
10. The first draft was pilot tested with individuals and revised.
11. The subjects for field testing were selected and pretested.
12. The subjects were given program, posttest, and retest.
13. The program data and test results were collected and analyzed.

General Statement

A general statement was written which described the purpose of the intended program, roughly set the subject matter limits, described possible limitations and aspirations of the subjects in detail, and proposed ultimate utilizations of the program of instruction.

Student Population

The eighty students enrolling in the Woodwinds Applied Music Methods and Materials I course at The Ohio State University, Autumn Quarter, 1971 provided the population for the study. Based upon the prior experience of the writer, it was assumed that the population would be typical of music education majors at The Ohio State University. Of the eighty students enrolled in four Woodwind Methods classes, three students dropped the course. Four others were judged to have had formal training in principles of woodwind pedagogy and were not included in the study. The remaining seventy-three students constituted the subjects for this investigation.

Instructional Objectives

Pipe views the defining of objectives as the most critical step in programing.[12] The purpose of the instructional objective is to describe what the learner will be doing when demonstrating his achievement of the subject matter, and how one will know when the learner is doing it.[13]

Several decisions were made:

1. The instructional objectives would represent the

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[12]Pipe, op. cit., p. 21.

[13]Robert F. Mager, Preparing Instructional Objectives (Palo Alto: Fearon Publishers, Inc., 1962), p. 53.

behavior which could reasonably be expected of a beginning clarinet teacher.

2. Specific motor fingering knowledge would not be part of the above behavior. It was considered impractical to replicate the efforts of Bigham[14] because the programing of fingerings would greatly increase the length of the program.

3. In order to specify the conditions under which the behavior would occur, a format for the Criterion Test was chosen at this time.

The instructional objectives are presented in Appendix I.

A provisional listing of prerequisite skills was devised and attached to the pyramid of instructional objectives. The provisional list was a device used by the investigator in checking his own assumptions about the musical experiences of the target population. For example, an instructional objective states that the student, given a choice of tuning sequences, will be able to select the correct procedure to tune the clarinet. If rote memorization is desired, the programer can shape the learner's behavior; sufficient practice may insure permanence of learning. If the programer wishes to teach for a transferential understanding of the underlying rationale for tuning the clarinet, a decision must be made that the target population has or has not a sufficient understanding

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[14]William Marvin Bigham, Jr., "A Comparison of Two Response Modes in Learning Woodwind Fingerings by Programmed Text" (unpublished doctoral dissertation, Florida State University, 1965).

of wind instrument acoustics for the rationale to be transferential.

Criterion Test

Norm-referenced attainment tests are used in measuring individual differences between students, whereas criterion-referenced tests are designed to measure the effects of a program of instruction. The concern is not with difficult or easy questions, nor in grading students.[15] The criterion test is useful in making decisions concerning the possible revision of program content due to vague or poorly sequenced frames, or because the programer had misjudged his target population.

Several five-item multiple-choice questions were written for each instructional objective. The use of four distractor items permitted the testing of as many as five concepts for each instructional objective. The final revised criterion test consisted of thirty-four questions--one five-item question for each instructional objective. These items were judged to represent an adequate population of items for determining whether the student had reached criterion performance.

In order to avoid the inadvertent selection of less relevant questions, the construction of a criterion test was purposely sequenced before the program content was

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[15]Pipe, op. cit., p. 27.

developed. The Clarinet Criterion Test was believed to have face validity in that it was devised directly from the instructional objectives, for example:

Instructional Objective: Given multiple choice questions concerning poor tone due to faulty reed/mouthpiece combination, student will be able to select probable causes.

Question: A hard, raucous tone may be caused by: (A) #2 reed matched with close lay mouthpiece (B) #3 reed matched with open lay mouthpiece (C) #1 reed matched with close lay mouthpiece (D) #1 reed matched with open lay mouthpiece (E) #3 reed matched with close lay mouthpiece.

To verify this estimate of content face validity, both the Instructional Objectives and the Clarinet Criterion Test were submitted to four experts in the field of instrumental pedagogy.[16] They were asked the following questions:

1. Do the Instructional Objectives represent the performance which could reasonably be expected of a beginning instrumental music teacher?
2. Does the Clarinet Criterion Test test the behavior required by the Instructional Objective?

The content validity of the Instructional Objectives and the Clarinet Criterion Test was established by the agreement of the four experts.

Program Content

The program content was determined by the pyramid of instructional objectives and prerequisite skills. The

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[16]Mr. Jack O. Evans, Dr. Donald E. McGinnis, Dr. Robert Titus of The Ohio State University, Dr. George H. Wilson, Roosevelt University, Chicago, Illinois.

distractor items in the Clarinet Criterion Test also suggested additional facts, concepts, and principles to be included. The programer approached the sequencing of the basic content divisions with two caveats in mind:

1. The order and level of presentation that make it easiest to learn are not necessarily the order and level in which the expert stores information in his mind.[17]

2. It is easy to forget that the behaviors one goes through to master the subject matter may be different from the actual subject matter behaviors.[18]

It was decided to sequence the content in the order that a teacher might use it to give a student his first (or first few) lessons. The sequence was as follows:

1. Handling and Assembly
2. Reeds and Mouthpieces
3. Posture and Breath Control
4. Embouchure
5. Tone Production
6. Hand and Finger Position
7. Articulation
8. Tuning and Intonation
9. Care and Maintenance

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[17]Pipe, op. cit., p. 30.

[18]Thomas F. Gilbert, "On the Relevance of Laboratory Investigation of Learning to Self-Instructional Programming," in Teaching Machines and Programmed Learning: A Source Book, A. A. Lumsdaine and Robert Glaser, eds. (Washington, D.C.: National Education Association, 1960), pp. 478-79.

The programer sought the aid of several experts concerning areas of pedagogical controversy[19] and the ever-present problem of semantics.

Program Types and Techniques

It was decided that a textbook format of some kind would avoid the lack of media standardization currently existing in instructional technology. The typical programed-text format is not without inherent problems, however, as Dallin points: "One problem is that adherence to discrete frame divisions limits the illustrations and examples and restricts the mode and frequency of responses. Another is that the space on a page is not used efficiently."[20]

Guides for constructing the first chapter resulted in the following format:

1. The sequence was primarily linear, but did not rule out "washing back" or "looping forward."
2. The form and structure, utilizing a full 8 1/2 by 11 inch page, was tailored to the instructional objective without regard to discrete frame divisions.
3. The learner was to slide a masking card down the page to a line of asterisks at which point a question is presented; the learner would make a response and find the correct answer below the line.

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[19]The standard pedagogy texts do not agree in all respects. See Bibliography for listing.

[20]Leon Dallin, "Music Educators Should Get with the Program," Music Educators Journal, LV (March, 1969), 51.

4. Due to anticipated learner unfamiliarity with the clarinet, the stimulus presentation was dependent upon copius illustrations.

Guides to an appropriate response mode were those reviewed and summarized by Glaser.[21] When the criterion performance includes:

1. a precise response topography, use constructed response.
2. recognition, the form is unimportant.
3. fine stimulus discriminations, use alternative response choices.
4. elementary concept learning, choose presence or absence of concept.

A chapter introduction told the student what he would learn, the main body told him what he was learning, a summary at the end told him what he had learned. Review questions were seeded through the chapter as related material was introduced. Other review techniques were incorporated into some answers, e.g., telling the learner why he was correct.

Gilbert's "mastery performance" principle was incorporated in the early stages of learning; the student began to solve problems as quickly as was feasible. If it can be assumed that at least a part of a person's aptitude for being an instrumental music teacher is the ability to solve

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[21]Robert Glaser, "Toward a Behavioral Science Base for Instructional Design," Teaching Machines and Programed Learning, II: Data and Directions, Robert Glaser, ed. (Washington, D.C.: National Education Association, 1965), pp. 778-79.

problems, then practice in solving problems should lead to an enhancement of subsequent learning and achievement.

Programing Chapter I: The Model

Consistent with the plan to introduce content in the order that a teacher might present it to a beginning student, the first chapter dealt with safety and handling procedures, nomenclature, fitting of tenon corks, and assembly of the clarinet parts.

A look-alike learning format was avoided by varying EGRUL (example-rule) and RULEG (rule-example), full page and small scattered illustrations, and medium and small frames. The required responses varied among constructed response, matching, multiple-choice, and no response. Prompting and confirmation modes of feedback were employed.

Chapter I was pilot tested with three college music majors; two of them were 'cello and piano majors respectively with no pedagogy background; the third was a saxophone major who had completed the woodwind pedagogy course. The students were not pretested, but were posttested. Their scores for twenty-one frames in the program were: three wrong, none wrong, and two wrong. Of nine criterion posttest questions, two subjects had no mistakes and one subject missed one question.

It became evident from watching the subjects use the program that two of the three did not understand how to use

the answer shield as a masking device. Instructions concerning the answer shield were revised.

Two subjects did not respond to the following frame:

> QUESTION: If the cork tenon must be sanded, be sure to reapply grease/oil before assembling the joint.
>
> **********
>
> grease

The subjects did not understand that a choice was required, accepted "grease or oil" as being correct, and responded "true." The programer noted two principles:

1. Use thematic prompts early in the program.
2. Avoid trying to teach and test by the use of distractor choices.

The frame was revised as a prompted constructed response, and additional information was worked into the feedback:

> QUESTION: If the cork tenon must be sanded, be sure to apply cork _____ before assembling the joint.
>
> **********
>
> grease--never oil--and since you can't put cork back on, sand off only a bit at a time.

The following question was devised to review the idea that ungreased tenon joints may not fit together, to explicitly suggest a result (they may come apart), and to test for prerequisite knowledge (a longer tube produces a

lower pitch).

> QUESTION: Because the tenon corks are not greased, Daisy cannot fit the joints completely together. You fear the clarinet may come apart, and, although we haven't spoken about it, you anticipate an intonation problem. Do you think her pitch will be flat or sharp?
>
> **********
>
> flat (more about this later)

All subjects responded correctly, but two of them questioned whether other students would remember their physics. It was the programer's assessment that to challenge the learner's problem-solving ability, to force him to draw appropriate generalizations or conclusions from his experience, and to think out a problem consciously within as large a step size as possible, would enhance the student's appraisal of his learning as truly "mastery performance."

First Draft Programed

Because the subjects had responded correctly to criterion test questions concerning the handling of the clarinet (possibly involving learning in which proprioceptive responses were a mediating process), it was decided to program the remaining eight chapters with a similar flexible approach toward format, techniques, and style.

The first draft of the Programed Textbook in Clarinet Pedagogy was completed in August, 1971. The program,

which was 85 pages in length, was divided into nine chapters, and asked 143 questions. The first draft was pilot tested with an individual student who was a violin player, and who had no knowledge of woodwind pedagogy. A grouping of errors lead to an examination and revision of material in Chapter VIII concerning the tuning of the clarinet. The entire program was then read by a clarinet teacher who made technical suggestions which resulted in minor revisions.

It was anticipated that further pilot testing and the addition of numerous frames would result in lower error rates, higher criterion test scores, increased program times, and a corresponding loss in program efficiency. Because the program was intended for use in a normal classroom context which would include holding and playing the actual instrument, the programer deliberately underprogramed. In contrast with Skinner's five to ten per cent and Crowder's fifteen per cent error rates, an error rate of from twenty to twenty-five per cent was anticipated from the self-contained use of the program under controlled conditions.

It was decided that reproducible results indicating the effectiveness of the text by itself, would be useful in evaluating the effectiveness of the programed textbook. A later field test combining programed and classroom instruction would reveal another kind of effectiveness, and

would result in practical revisions based upon performance in a classroom context. The Programed Textbook in Clarinet Pedagogy was therefore deemed ready for testing under restrictions.[22]

Testing Procedures

The design of the study, expressly restricting extra-program learning, made necessary the scheduling of the investigation at the beginning of the quarter before any classroom learning commenced. The Clarinet Criterion Test was administered to the subjects in each class as a pretest on the first day of classes. The subjects were instructed: (1) to complete the Programed Textbook in Clarinet Pedagogy outside of class; (2) to neither discuss the materials with anyone nor to use any supplementary materials; (3) that they would receive no grade of any kind on their performance on the program; and (4) to return to class after one week.

The pretest questions were randomized and Form B was administered as a posttest to the subjects on their return. Normal classroom procedures followed the posttest during the class period in which the test was given, and the subjects were instructed to again return in one week. At that time, half of the subjects received Form A and half

[22]Instructions for use and selected pages of the program are presented in Appendix II.

received Form B of the Clarinet Criterion Test. This third administration of the criterion test, a retest, was given in order to obtain an estimate of the reliability of the measure.

At no time during the study were the subjects given any information concerning their responses on the three administrations of the criterion test. The criterion test consisted of 34 five-item multiple-choice questions, that is, 34 correct items and 136 plausible distractor items. None of the test questions was the same as the terminal frames in the programed textbook.

Data Analysis Techniques

The data were analyzed for means, standard deviations, and *t* value. A computer program for those data was used which was developed by Madhukar B. Golhar, Programmer, Instruction and Research Computer Center, The Ohio State University. Program BMDO3D, a program for the Pearson Product Moment Correlation, was used to obtain an estimate of the reliability of the Clarinet Criterion Test. The investigator calculated raw scores, ranges, modes, and medians for the three administrations of the criterion measure, mean gains, mean times to complete the program, and mean program error rates.

CHAPTER IV

ANALYSIS OF DATA

The major findings of the study are presented in this chapter. An analysis of data is presented as it related to program effectiveness, stability of the criterion measure, and differences between groups.

Results

The effectiveness of the Programed Text in Clarinet Pedagogy in meeting the instructional objective was determined by statistically analyzing the data obtained from the various administrations of the Clarinet Criterion Test. A paired observation *t* test for the significance of the difference between the pretest and posttest means was used for this purpose. The results of this procedure are presented in Table 1.

A *t* value with 60 degrees of freedom must be 2.39 for a one tailed test to be significant at the .01 level. The computed *t* value of 21.5406 with 72 degrees of freedom was significant beyond the .01 level, and indicated a significant increase in performance resulted from the introduction of the program of instruction.

TABLE 1

COMPARISON OF DIFFERENCES BETWEEN PRETEST AND POSTTEST MEANS FOR CLARINET CRITERION TEST

Measure	Mean	Standard Deviation	Mean Difference	t	P
Pretest	12.3	4.29			
			10.9	21.5406	$<.01$
Posttest	23.2	4.98			

An estimate of the stability of the Clarinet Criterion Test was obtained by the test-retest procedure. One week after the posttest administration, forms A and B of the measure were randomly assigned to the subjects. Illness and an unexpected meeting prevented seventeen subjects from attending class that day. Previous testing conditions were controlled, and the absentees were not permitted to participate in a re-administration of the measure. The data were subjected to a Pearson Product Moment Correlation, resulting in a reliability coefficient of .90.

Ranges, modes, medians, means, and standard deviations for the pretest, posttest, and retest administrations are presented in Table 2.

TABLE 2

COMPARISON OF RANGES, MODES, MEDIANS, MEANS, AND STANDARD DEVIATIONS FOR THE THREE ADMINISTRATIONS

Measure	No. Items	N	Range	Mode	Median	Mean	Mean Gain	S.D.
Pretest	34	73	4-23 (19)	10,14	12.2	12.3		4.29
							10.9	
Posttest	34	73	9-31 (22)	26	24.2	23.2		4.98
Retest	34	56	12-29 (17)	25	23.5	22.6		4.52

Secondary Analysis

The seventy-three subjects constituting this study varied considerably in musical experience, teaching experience, instrumental background, and interest in teaching the clarinet to beginners. It is assumed that differences in motivation to learn and in effort to use the programed textbook would result from divergent goals and from the lack of such extrinsic motivators as a class grade for individual performance.

In an attempt to ascertain whether patterns of program performance existed according to the subject's performing major or to prior woodwind background, a grouping of data by various backgrounds was compiled. The data included mean pretest, posttest, and raw gain score, mean

gain expressed as a percentage, mean retest raw score, mean time to complete the program expressed in minutes, and mean program error rate expressed as a percentage. Ranges for the above are reported in parentheses. The data were grouped according to the subjects' prior woodwind experience and performing major. Data showing these groups subdivided as to specific background, e.g., "clarinet majors" or "voice majors" are presented in Table 3 and Table 4. The groups are arranged in order of decreasing posttest scores. Means and ranges for subjects grouped according to woodwind background are presented in Table 5. All raw data, including the major performance instrument and years of prior woodwind experience, appear in Appendix III.

It may be noted that subject number 31 (see Appendix III), a clarinet major, scored the highest pretest score, but made no gain on the posttest. Subject number 9 (see Appendix III), a voice major, contributed the single negative gain score to the study, scoring one less on the posttest than on the pretest. The range of scores on the pretest for all subjects was from 4 to 23. The range on the posttest was from 9 to 31. The mean gain on the posttest was 10.9, and, expressed as a percentage, indicated a 108 per cent gain in criterion performance.

One posttest criterion question in each chapter, except Chapter II and Chapter VII, was missed by fifty per

TABLE 3

MEANS AND RANGES FOR SUBJECTS WITH WOODWIND BACKGROUND GROUPED ACCORDING TO MAJOR

	Pre	Post	Gain	Gain (%)	Retest	Program Time Minutes	Program Error Rate (%)
N = 5	Non-Woodwind Majors: Woodwind Background Except Clarinet						
Mean	12.8	25.8	13.0	146	23.5[a]	132	7.5
Range	(5-21)	(23-29)	(8-18)	(38-360)	(21-26)	(105-180)	(1.3-13.9)
N = 6	Clarinet Majors						
Mean	17.2	25.5	8.3	58	23.5[b]	138	2.9
Range	(11-23)	(20-29)	(0-14)	(0-117)	(19-29)	(90-180)	(.6-5.5)
N = 6	Non-Woodwind Majors: Clarinet Background						
Mean	15.7	24.0	8.3	55	24.0[c]	155	5.0
Range	(12-19)	(19-28)	(5-10)	(26-64)	(17-29)	(105-210)	(2.7-7.6)
N = 2	Woodwind Majors: No Clarinet Background						
Mean	12.0	19.5	7.5	67	24.0[d]	125	7.6
Range	(8-16)	(15-24)	(7-8)	(50-88)	(24)	(105-145)	(2.7-12.5)
N = 19	Total Subjects: Woodwind Background						
Mean	15.0	24.5	9.5	81	23.7[e]	140	5.3
Range	(5-23)	(15-29)	(0-18)	(0-360)	(17-29)	(90-210)	(.6-13.9)

[a] N = 4; [b] N = 4; [c] N = 5; [d] N = 1; [e] N = 14.

TABLE 4

MEANS AND RANGES FOR SUBJECTS WITHOUT WOODWIND BACKGROUND GROUPED ACCORDING TO MAJOR

	Pretest	Posttest	Gain	Gain (%)	Retest	Program Time Minutes	Program Error Rate (%)
N = 14				Brass Majors			
Mean	13.5	24.8	11.4	91	23.2[b]	160	8.4
Range	(9-18)	(13-30)	(4-20)	(33-200)	(14-29)	(60-210)	(4.8-13.2)
N = 3				Dual Majors			
Mean	14.0	24.7	10.7	76	22.5[c]	200	6.2
Range	(14)	(22-26)	(8-12)	(57-86)	(25-26)	(90-270)	(2.0-9.7)
N = 4				Percussion Majors			
Mean	12.8	24.0	11.3	90	27.0[d]	199	11.1
Range	(8-17)	(14-30)	(6-16)	(53-117)	(25-29)	(165-240)	(3.4-16.7)
N = 7				Keyboard Majors			
Mean	9.7	22.9	13.1	152	20.5[e]	184	9.3
Range	(5-14)	(14-31)	(5-17)	(90-340)	(12-27)	(120-210)	(4.1-16.0)
N = 7				String Majors			
Mean	10.0	22.3	12.3	135	22.2[f]	176	12.3
Range	(6-14)	(17-27)	(9-17)	(86-283)	(17-28)	(60-300)	(2.0-20.2)
N = 13				Voice Majors			
Mean	10.6	21.1	10.5	126	20.6[g]	173	10.9
Range	(4-18)	(9-28)	(-1-16)[a]	(-10-375)[a]	(13-26)	(60-225)	(2.0-28.6)
N = 6				Theory Majors			
Mean	10.0	20.2	10.2	138	20.7[h]	105	9.1
Range	(5-18)	(11-30)	(2-15)	(14-300)	(14-28)	(60-240)	(2.7-18.8)
N = 54				Total Subjects: Without Woodwind Background			
Mean	11.4	22.7	11.3	117	22.2[i]	167	9.8
Range	(4-18)	(9-31)	(-1-20)[a]	(-10-375)[a]	(12-29)	(60-300)	(2.0-28.6)

[a]Negative number to positive number.

[b]N = 11; [c]N = 2; [d]N = 3; [e]N = 6; [f]N = 6; [g]N = 11; [h]N = 3; [i]N = 42.

TABLE 5

COMPARISON OF MEANS AND RANGES FOR SUBJECTS GROUPED ACCORDING TO BACKGROUND IN WOODWIND PERFORMANCE

	Pre	Post	Gain	Gain (%)	Retest	Program Time Minutes	Program Error Rate (%)
N = 19			Subjects with Woodwind Background				
Mean	15.0	24.5	9.5	81	23.7[b]	140	5.3
Range	(5-23	(15-29)	(0-18)	(0-360)	(17-29)	(90-210)	(.6-13.9)
N = 54			Subjects without Woodwind Background				
Mean	11.4	22.7	11.3	117	22.2[c]	167	9.8
Range	(4-18)	(9-31)	(-1-20)[a]	(-10-375)[a]	(12-29)	(60-300)	(2.0-28.6)

[a]Negative number to positive number.

[b]N = 14; [c]N = 42.

cent or more of the subjects. The related material in the program is to be analyzed for purposes of revision.

Times to complete the program ranged from one hour to five hours. The eight subjects indicating a program completion time of one hour registered a mean posttest score of 21.5, mean pretest-posttest gain of 11.3, mean percentage gain of 123 per cent, and program error rate of 9.3 per cent. The subject indicating a program completion time of five hours registered a posttest score of 17, pretest-posttest gain of 9, a 113 per cent gain in criterion performance, and a program error rate of 17.4 per cent. The mean time for all subjects to complete the program was two

hours and forty minutes. The mean program error rate was 8.7 per cent. Any analyzation of the data should be made in light of the fact that the subjects reported their own program completion times and number of errors committed while working the program.

An analyzation of incorrect responses on the program revealed that three questions in each of Chapters I and IV, two questions in Chapter II, and one question in each of Chapters III, V, VII, and VIII were incorrectly responded to by 20 per cent or more of the subjects. Of the twelve questions, eight required from 2 to 14 separate responses to be considered correct. All twelve questions will be analyzed with a view to possible revision and to the insertion of additional practice frames. Data concerning the number of questions asked in each chapter, total number of responses by 73 subjects, number of incorrect responses and percentage of errors for each chapter are presented in Table 6.

Additional Information

The data from four subjects, having completed a woodwind methods class within the past three years, were excluded from the study. It is interesting to note the relatively high pretest-posttest scores and low error rates of the instrumental majors. The group uniformly performed below the mean in percentage of gain from pretest to posttest.

TABLE 6

INCORRECT RESPONSES BY
PROGRAM CHAPTER

	Program Chapter	Number of Questions	Total Responses*	Number of Incorrect Responses	Response Error Rate (%)
I	Handling & Assembly	21	1533	160	10.43
II	Reeds & Mouthpieces	20	1460	151	10.34
III	Posture & Breath Control	8	584	44	7.53
IV	Embouchure	11	803	98	12.20
V	Tone Production	17	1241	86	6.92
VI	Hand & Finger Position	14	1022	98	9.58
VII	Articulation	17	1241	108	8.70
VIII	Tuning & Intonation	18	1314	101	7.68
IX	Care & Maintenance	17	1241	62	4.99
	Total	143	10439	908	

*Number of responses in each chapter by 73 subjects.

It is assumed that the lower mean gain was probably a result of previous experience. These data are presented in Table 7.

TABLE 7

STUDENTS WITH PRIOR PEDAGOGY BACKGROUND: DATA NOT INCLUDED IN THIS STUDY

Subjects	Pre	Post	Gain	Gain (%)	Retest	Program Time Minutes	Program Error Rate (%)
A[1]	21	30	9	43	31	150	.6
B[1]	22	28	6	27	28	75	5.5
C[2]	17	23	6	35	19	165	9.0
D[2]	15	18	3	20	17	180	6.9
Mean	18.8	24.8	6	31.3	23.8	143	5.5

[1]brass majors.

[2]voice majors.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Purpose of the Study

The purpose of this study was to determine the feasibility of developing a program of instruction in the methods of teaching beginning clarinet players. The study sought to identify a body of knowledge concerning clarinet pedagogy appropriate to the prospective instrumental teacher, to develop a textbook concerning clarinet pedagogy utilizing programed instruction techniques, and to evaluate the effectiveness of the textbook as an instructional method.

Limitations

The study was limited to determining the feasibility of developing a programed textbook through which principles of clarinet pedagogy could be learned by college music education students. An assessment of the effectiveness of the programed textbook was determined by an analysis of the difference between pretest and posttest scores. The study was not concerned with a comparison of the effectiveness

of the programed instruction with any other type of instruction. No attempt was made to measure such variables as readiness, motivation, or factors connected with the transfer of cognitive training to motor skills. In an effort to assess only that learning which resulted from the use of the programed textbook, the design of the study restricted extra-program learning.

Subjects

Seventy-three students enrolled in four woodwind methods classes at The Ohio State University provided the population for this investigation. The subjects had little or no knowledge concerning principles of woodwind pedagogy.

Procedures

Prior to selecting the program content, several preliminary steps were undertaken such as the writing of a general statement describing the subjects and the purpose and limits of the subject matter; defining the instructional objectives in behavioral terms; and the preparation of a criterion test devised directly from the instructional objectives and designed to measure the effectiveness of the program of instruction. To verify the content face validity of the measure, both the instructional objectives and the Clarinet Criterion Test were submitted to four experts in the field of instrumental pedagogy.

Selection of the program content was determined by a pyramid of instructional objectives. The content was sequenced in the order that a teacher might use it to give a student his first lesson. The program format was basically linear, utilizing copius illustrations without regard to discrete frame divisions. The specific criterion performance required of the learner determined appropriate response modes, step size, and feedback mode. A central consideration was the development of mastery performance by means of early problem solving activities.

A pilot testing by three subjects and revision of the first chapter provided the basis upon which decisions were made concerning format, techniques, and style for subsequent chapters. The completed first draft was pilot tested by a single student, revised, checked for accuracy by a subject matter expert, and submitted to a large group for testing under controls that restricted extra-program learning.

Testing procedures consisted of the administration of a pretest on the first day of classes and a posttest of the same questions in a different randomized order one week later. One week after the posttest administration a third administration of randomly assigned alternate forms of the criterion test was given. No classroom instruction commenced until the program and all three tests were completed by the subjects.

Results

Means and standard deviations were computed for the various administrations of the criterion test. A paired observation *t* test calculated for the significance of the difference between the pretest and posttest means was significant beyond the .01 level. In an attempt to estimate the stability of the criterion test, the posttest-retest data was analyzed by means of a Pearson Product Moment Correlation, resulting a reliability coefficient of .90.

Other results include: (1) mean time to complete the program was two hours and forty minutes; (2) mean program error rate was 8.7 per cent; and (3) mean gain on the posttest was 10.9, indicating 108 per cent gain in criterion performance.

Conclusions

The study indicates that it is feasible:

1. To identify a body of knowledge concerning clarinet pedagogy appropriate to the prospective instrumental music teacher.
2. To develop and construct a textbook about clarinet pedagogy utilizing programed instruction techniques appropriate to college music education students.

3. To evaluate the effectiveness of the programed instruction in clarinet pedagogy by means of a criterion test.

A program of instruction was developed which effectively taught a content of clarinet pedagogy. The knowledge of clarinet pedagogy, as measured by the Clarinet Criterion Test, was significantly increased through the utilization of the Programed Text in Clarinet Pedagogy.

Recommendations for Further Research

The results of this study suggest that:

1. Various wind, string, and percussion minor instrument areas could make use of the rigorous procedures of program development in identifying and organizing a body of pedagogical knowledge appropriate to each area.
2. In an attempt to deal with both pedagogical and performance skills in the minor instrument class, a further investigation should be undertaken to assess the effectiveness of combining programed and classroom instruction.
3. A study could be made to determine an effective analyzation procedure for the differentiation of training tasks related to the act of instrumental music teaching.

4. Research could be instituted to investigate the problem of the transfer of cognitive training as it relates to those motor skills needed by the instrumental music performer in the minor instrument class.

APPENDIX I

INSTRUCTIONAL OBJECTIVES FOR CLARINET PROGRAM

INSTRUCTIONAL OBJECTIVES FOR CLARINET PROGRAM

Assembly and Handling

Given multiple choice questions of clarinet cases being carried, student will be able to select those cases being safely carried.

Given a list of part names and a drawing of disassembled clarinet parts, student will be able to match each part to its name.

Given multiple choice questions presenting problems of tenon joints which fit too snugly or too loosely, the student will be able to select the correct remedial solutions.

Given multiple choice questions, the student will be able to identify the ring key which should be depressed to prevent bending of the bridge keys.

Given multiple choice questions, the student will be able to select the correct sequence of assembling the clarinet.

Given multiple choice questions, the student will be able to select the correct procedures of assembling the clarinet.

Given multiple choice questions, the student will be able to select procedures of correctly assembling the tone generating mechanism.

Given multiple choice questions, the student will be able to select correct steps and procedures for disassembly.

Reeds and Mouthpieces

Given multiple choice questions, student will be able to identify correct statements concerning reed and mouthpiece selection.

Given descriptions of reeds, student will be able to select best reed.

Given a list of nomenclature and a drawing of a reed, student will be able to identify correct nomenclature.

Given multiple choice questions, student will be able to identify correct statements concerning reed preparation.

Given a list of nomenclature and a drawing of a mouthpiece, student will be able to identify correct nomenclature.

Posture and Breath Control

Given multiple choice questions describing faulty posture and position, student will be able to select the probable result of each faulty position.

Given a list of statements concerning inhalation and exhalation, the student will be able to select those principles commonly accepted as enhancing the control of inhalation and exhalation.

Embouchure

Given a list, student will be able to select those principles which make for an embouchure capable of producing an acceptable tone.

Given multiple choice questions, student will be able to differentiate between good and poor embouchures.

Tone Production

Given multiple choice questions concerning poor tone due to faulty embouchure, student will be able to select probable causes.

Given multiple choice questions concerning poor tone due to faulty reed/mouthpiece combination, student will be able to select probable causes.

Given multiple choice questions concerning poor tone due to faulty reed adjustment, student will be able to select probable causes.

Given multiple choice questions concerning poor tone due to faulty conditions of throat and breath, student will be able to select probable causes.

Given multiple choice questions concerning the occurrence of squeaks, student will be able to select probable causes.

Hand and Finger Position

Given a list, student will be able to select those principles of finger and hand position which make for a smooth, even technique.

Given multiple choice questions concerning faulty technique, student will be able to select probable causes or remedial solutions.

Articulation

Given multiple choice questions concerning steps in articulation, student will be able to select the best sequence of steps.

Given several typical articulation problems, student will be able to select probable solutions from list of possible solutions.

Tuning and Intonation

Given a choice of tuning sequences, student will be able to select the correct procedure.

Given problems of reed/mouthpiece and intonation, student will be able to select probable causes.

Given problems of embouchure and intonation, student will be able to select probable causes.

Given problems of dynamics and intonation, student will be able to select probable causes.

Care and Maintenance

Given multiple choice questions, student will be able to select correct procedures for swabbing the clarinet.

Given multiple choice questions, student will be able to select correct procedures for care of the reed.

Given multiple choice questions, student will be able to select appropriate maintenance procedures.

Given typical malfunction problems of the clarinet, student will be able to select from multiple choice questions the probable causes.

APPENDIX II

SELECTED PAGES

PROGRAMED TEXTBOOK IN CLARINET PEDAGOGY

INTRODUCTION

This is a programed textbook in clarinet pedagogy. It is not designed to be read as a normal textbook.

Programing offers you carefully sequenced increments of knowledge. After most increments, you will be asked a question designed to demonstrate your grasp of the content.

THERE ARE NO TRICK QUESTIONS--learning is the name of this game. But if you miss a question, go back and try to determine WHY you missed it. Maybe it was a bad question--we hope there aren't many of those.

Move along at your own pace, but please do not start a chapter if you may be distracted by others in the room, or if you do not have time to complete the chapter.

It is not necessary to write any answers in this booklet. Think a specific answer, commit yourself, check the printed answer, and jot down the number of the question on the answer shield (last page) ONLY if you missed it. YOU make the decision whether your covert response was close enough to the printed answer to be considered correct.

I need your list of missed questions in order to find out WHERE to make necessary revisions in the program--in order to promote better and easier learning with next year's class.

What you LEARN from this program, from class sessions, and from your textbook will tend to determine your performance on the mid-term and final exams.

You will receive NO GRADE OF ANY KIND for your performance in this program--you cannot pass or fail it--you can only learn from it.

And if you do not learn, it is not your fault. It is the programer's fault. Somehow I caused your incorrect response, and that is why I need your list of missed questions.

(now, please tear out the last page)

Perhaps both situations could have been avoided by:

(1) instructing all area music stores to properly prepare instruments ahead of time

(2) personally checking instruments which are given, loaned, or sold privately to your students in plenty of time to have them repaired.

There are several procedures during assembly which will help avoid costly repairs.

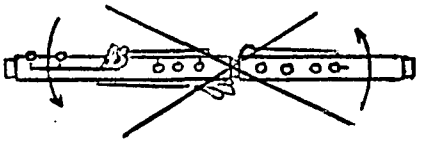
A. Avoid excessive pressures on rods and keys by

(1) grasping the body spaces of the instrument which are devoid of mechanism

(2) pushing down on keys which fit solidly against the instrument body.

B. Keep joints parallel, not

C. Push completely together with only minimum twisting.



Question (11): As Samson is assembling his clarinet, you notice he has formed a grip over the unsupported side spatula keys. Since you know these keys will easily bend, what two specific suggestions could you give him?

****

1. grasp clarinet body where there is no mechanism
2. grasp around (or push down) keys which fit solidly against the body

QUESTION (12); Delbert is not keeping the joints parallel during assembly. What result do you anticipate?

****

a broken tenon joint

. . . . . .

There are many pet ways of breaking in a reed (sealing the pores and gently exercising the fibers). The "natural" method is to play the reed only five minutes a day. The pores will usually be closed in from three to seven days.

QUESTION (34): A reed is considered to be broken in when it is NOT possible to raise _____ on the vamp by blowing through the reed from the butt/tip end.

****

Bubbles, butt

Another method, after soaking the reed a minute, is to place it on a flat surface and rub firmly with the thumb from bark to tip. Play a few minutes, dry, and repeat next day and until pores are sealed. This may be quicker than the "natural" method.

A third method: soak, rub on newspaper collecting some ink on the flat side, dry, and repeat process two more days. Play only on the fourth day.

Every clarinetist has his own recipe, but authorities are unanimous in prescribing very short playing periods until the reed is broken in.

Reeds should always be permitted to dry after being played:

(1) wipe off excess moisture
(2) dry on flat surface--use a commercial reed holder, or a flat piece of glass (rubber band will secure the reed)

QUESTION (35): Although there are various ways to break in a new reed, name one prescription common to all methods.

****

play only for short periods of time to allow fibers to rest

QUESTION (36): After a reed is broken in it may be played for rather long periods of time, but it should always be allowed to thoroughly ____ out and "rest" after being played.

****

. . . . . .

QUESTION (46): If you have tried the above routine several times, you will probably have noticed that the more air exhaled, the more/less muscular pressure is necessary to maintain a CONSTANT air stream velocity.

****

more--if you don't agree, experiment with this important concept again

Try this device sometime. With a student leaning slightly forward, tighten a belt around his chest. When instructed to take a deep breath, he will invariably take the low, waist-filling-out kind you are after.

QUESTION (47): Knowing that rigidity spreads like rigor mortis, and that instructions to tense, harden, and tighten muscles can result in fatigue and loss of muscular control, can you think of several words, phrases, or devices to encourage optimum inhalation/exhalation? (your own answer)

****

(your answer)--its well to have 6 or 8 gimmicks and games at hand to get your point across in a nontechnical, "fun" manner.

QUESTION (48); Faulty posture may have both direct and indirect effect upon one's playing performance. Try to make the best matches between the following:

1. improper mouthpiece angle	A. rough, uneven finger technique
2. rigor mortis syndrome	B. tight, constructed tone
3. tense throat	C. lack of lip control on reed
4. shallow breathing	D. weak tone toward phrase endings
5. hands & fingers out of position	E. general fatigue
6. lack increasing stomach firming	F. can't play long phrases

****

. . . . . .

Biting the reed (excessive vertical pressures) can be a major problem at this stage because the student is trying so hard to succeed, or because of YOUR choice of words and emphasis.

QUESTION (60): Pick out the one word or phrase from the list below LEAST likely to encourage biting.

A. tighten up
B. firm
C. tense
D. bite down
E. harden
F. press tightly
G. pinch

****

we failed to make our point if you didn't select B

In this chapter you have learned:

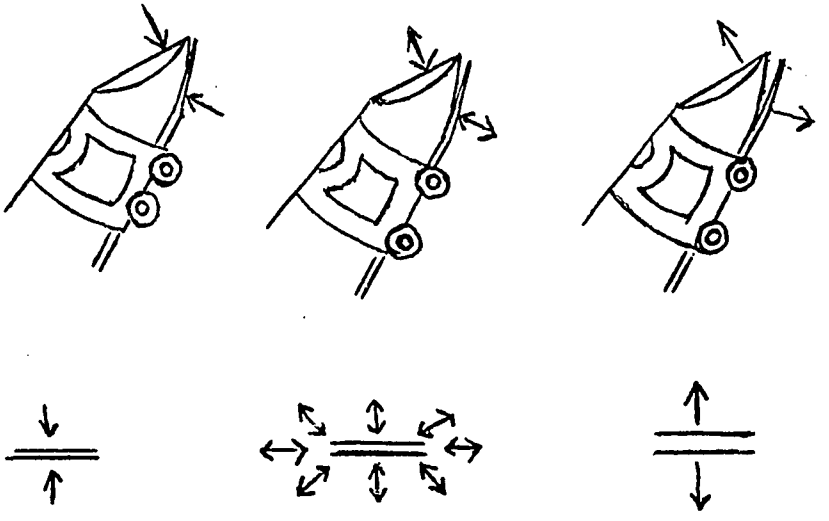
1. how to form a basic embouchure
2. initial tone production procedures
3. how to deal with some common problems

Chapter V

TONE PRODUCTION

A rich, resonant clarinet tone is essentially the product of reed/mouthpiece/clarinet, embouchure, breath control, and the player's concept of what the tone should be. Without benefit of a taperecorder, we will rely upon descriptive words such as "thin and pinched" or "squawky and unfocused."

Throughout this chapter, try to visualize the critically correct tip opening of a freely vibrating reed, the factors which would close off or open up the opening too much, and the amount of air pressure directed at the opening.



A weak air stream can only produce a weak tone, but it could be weak and THIN or weak and UNFOCUSED depending on embouchure pressures. An excessively strong air stream (overblowing) usually results in a loud, harsh tone quality, but it could be thin and strident or honky and raucous, both extremes having loudness.

QUESTION (61): A thin, strident tone may be the result of a pinched/flabby embouchure, and a weak/strong air stream.

****

. . . . . .

QUESTION (80):

1. If a student's lips are puckering forward, and

2. by wriggling the mouthpiece from side to side you discover a "floating" mouthpiece,

what may be the cause of each fault?

(in your own words)

****

1. right thumb is not supporting weight of clarinet which tends to pull lips forward

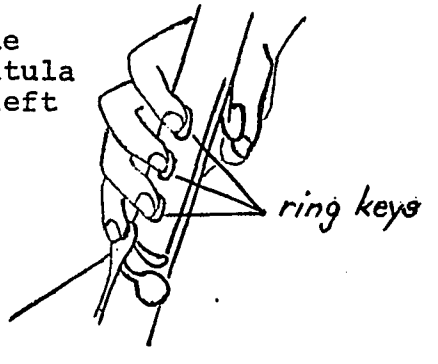
2. thumb is not pushing mouthpiece up against upper teeth which results in loss of "anchor"

QUESTION (81): If a student's finger TIPS are on the ring keys, would you expect the thumb rest to be contacted at the <u>base of thumbnail</u> or <u>first knuckle</u>?

****

first knuckle--causing high arch, finger TIP contact, hand tension

Students may now depress the three ring keys and bottom spatula key with right hand fingers (left hand is not used--hangs down loosely); students again blow open G for 6 to 10 seconds while you check hand position, mouthpiece angle, and upper teeth contact.



. . . . . .

CHAPTER VII

ARTICULATION

In this chapter you will learn:

1. prerequisites for good articulation
2. steps for teaching articulation to beginners
3. some general principles of tongue action
4. how to deal with common problems

Articulation is the action of starting and stopping the tone. Starting a tone is usually accomplished by removing the tongue from the reed, which permits the air stream to set the reed into vibration. Either replacing the tongue on the reed or ceasing to blow stops the reed from vibrating, thereby stopping the tone.

QUESTION (92): Select the false statements:

A. In order to produce sound, the reed must vibrate.

B. For the reed to vibrate, there must be a moving air stream.

C. The tongue must touch the reed to stop the tone.

D. When the tongue contacts the reed, the tone ceases.

E. There can be no sound until the tongue touches the reed.

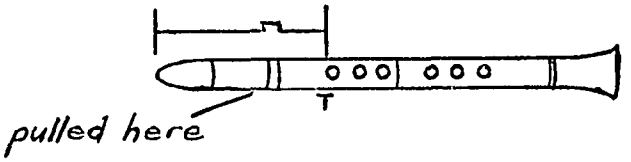
****

(C) discontinuing the act of blowing will also stop all tone
(E) tongue contact on the reed will prevent reed from vibrating

Certain "mechanical noises" are produced as the tongue controls the air stream by contacting and then coming away from the reed. The basic tone is never improved by the "sound" of starting and stopping it, and if the articulation is done poorly and rapidly, very little basic tone remains.

. . . . . .

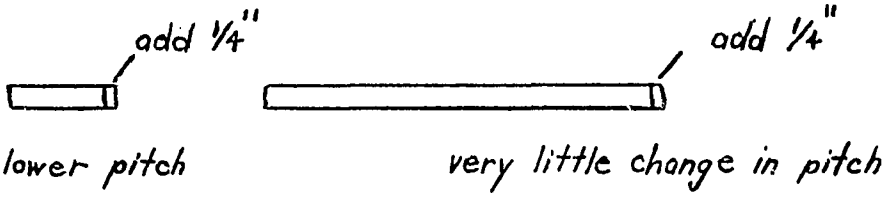
QUESTION (118): What will happen to the pitch of thumb F?



****

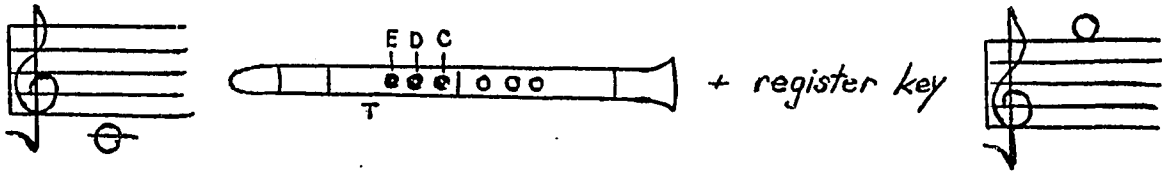
it will probably be flat (needing only a small pull to bring its pitch in tune)

Some of you may have intuitively observed at this point that a greater pitch CHANGE is produced by adding a quarter of an inch to a short tube than by adding a quarter of an inch to a long tube. Hence, the necessity for first tuning the "short" F, then "longer" G, finally "longest" B (which takes advantage of previous additions in length).



If you have played clarinet, skip to page 74 while the rest of us practice internalizing the F,G, B fingerings and barrel lengths

We have mentioned open G and thumb F often enough. Looking at the illustration, you can see that adding left 1st, 2nd, and 3rd fingers lowers the pitch to C. Since we prefer to tune to the slightly better in-tune G above the staff, we add the register key (clarinet overblows a 12th higher, not the octave as other wind instruments do).



. . . . . .

opening register key would make no difference in pitch--one could not play high notes with completely stopped-up tube

In this chapter you have learned:

1. how to get more mileage from a reed
2. how to swab a clarinet
3. to avoid heat and hot water with reeds and mouthpieces
4. to avoid extreme temperature changes with wooden clarinets
5. some simple maintenance procedures
6. to trace several common malfunctions by their pitch symptoms--and if you don't believe it, try this problem:

QUESTION (143): Your student cannot play ANY low notes--all fingerings sound a 12th higher. What do you suspect is the problem?

****

it could be a leaky register key pad--or the pad could be missing, the register key bent, spring broken, etc., etc.,but the point is, you knew where to START to look because of the symptoms. And with a little practice, you'll become quite expert at solving minor problems. Of course, if you set up a maintenance routine for your students, you'll have even fewer problems to solve.

APPENDIX III

SUBJECT DATA

TABLE 8

STUDENT DATA: RAW AND GAIN SCORES, TIME, ERROR RATE, MAJOR, AND YEARS WOODWIND EXPERIENCE

Student Number	Pre	Post	Gain	(%)Gain	Retest	Time	(%)Error Rate	Major	Years W.W. Experience
1	14	22	8	57		90	2.0	Theory/Piano	
2	8	17	9	113	18	300	17.4	String Bass	
3	16	24	8	50	24	105	2.7	Bassoon	Flute-3
4	10	24	14	140	23	150	15.3	Violin	
5	9	12	3	33	14	180	28.6	Voice	
6	14	25	11	79	20	180	8.3	Tuba	
7	14	26	12	86	26	165	2.7	Voice	
8	14	26	12	86	26	240	6.9	Voice/Piano	Clarinet-1
9	10	9	-1	-10		180	6.9	Voice	
10	14	21	7	50	24	180	2.7	Voice	
11	14	16	2	14	14	90	6.2	Theory	
12	12	24	12	100	20	180	13.2	Voice	
13	18	28	10	56	29	165	4.8	Voice	Clarinet-11
14	8	14	6	75		165	9.7	Percussion	
15	12	28	16	133	25	90	13.9	Voice	
16	10	25	15	150	23	120	4.1	Piano	
17	15	25	10	67	23	210	9.7	Voice	
18	18	26	8	44	24	210	16.7	Voice	
19	14	26	12	86	28	180	9.0	Violin	
20	5	23	18	360	21	180	9.0	Voice	Flute-4
21	5	11	6	120		60	18.8	Theory	
22	12	25	13	108		60	8.3	Theory	
23	17	26	9	53	27	180	3.4	Percussion	
24	15	24	9	60	22	120	7.6	String Bass	Clarinet-8
25	10	19	9	90		60	6.2	Trumpet	

TABLE 8--Continued

Student Number	Pre	Post	Gain	(%) Gain	Retest	Time	(%) Error Rate	Major	Years W.W. Experience
26	13	27	14	108	25	180	10.4	Violin	
27	18	24	6	33	25	60	4.8	Euphonium	
28	10	30	20	200		210	6.2	Trumpet	
29	5	18	13	260	15	225	2.0	Voice	
30	12	23	11	92	24	180	8.3	Trombone	
31	23	23	0	0	21	105	.6	Clarinet	Sax-4
32	6	23	17	283	22	180	20.2	String Bass	
33	9	20	11	122		60	2.0	Viola	
34	16	26	10	63	26	210	4.1	Oboe	Clarinet--2
35	4	19	15	375	21	165	13.2	Voice	
36	10	19	9	90		210	9.7	Piano	
37	15	29	14	93	28	270	9.0	Horn	
38	10	19	9	90	17	180	11.8	Violin	
39	5	20	15	300	20	240	2.7	Theory	
40	9	13	4	44	14	180	9.0	Euphonium	
41	12	26	14	117	25	210	14.6	Percussion	
42	14	26	12	86	25	270	9.7	Euphonium/Voice	
43	17	27	10	59	27	180	13.2	Horn	
44	15	30	15	100	25	180	7.6	Trombone	
45	10	24	14	140	22	165	9.7	Trumpet	
46	9	24	15	167	22	225	11.1	Voice	
47	12	26	14	117	25	150	5.5	Clarinet	
48	17	27	10	59	29	210	13.2	Tuba	
49	14	30	16	114	29	240	16.7	Percussion	
50	14	31	17	121	27	210	4.8	Piano	

TABLE 8--Continued

Student Number	Pre	Post	Gain	(%)Gain	Retest	Time	(%)Error Rate	Major	Years W.W. Experience
51	11	20	9	82	19	180	1.3	Clarinet	Sax-4
52	21	28	7	33		180	2.0	Clarinet	
53	18	30	12	67	28	120	2.7	Theory	
54	19	24	5	26		150	2.7	Piano	Clarinet-7
55	15	23	8	53	21	105	13.9	Piano	Sax-12
56	12	19	7	58	17	180	4.8	Oboe	Clarinet-4
57	12	28	16	113		60	7.6	Horn	
58	21	29	8	38		120	1.3	Voice	Sax-8
59	6	19	13	217		60	16.0	Theory	
60	8	23	15	188	17	120	7.6	Piano	
61	10	19	9	90	16	120	8.3	Trombone	
62	10	28	18	180	26	135	7.6	Piano	Flute-4
63	19	27	8	42		90	3.4	Clarinet	
64	17	29	12	71	29	120	4.8	Clarinet	Oboe-4
65	9	14	5	56	12	210	9.0	Organ	
66	6	16	10	167	13	180	11.8	Voice	
67	12	26	14	117	23	210	13.9	Piano	
68	18	29	11	61	25	180	5.5	Trumpet	
69	10	26	16	160		60	9.7	Voice	
70	5	22	17	340	21	210	16.0	Piano	
71	13	26	13	100	26	120	5.5	Harp	Flute-10
72	8	15	7	88		145	12.5	Flute	
73	14	23	9	64	26	105	6.2	Voice	

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