THE EFFECTS OF MASTERY LEARNING ON THE TEST PERFORMANCE OF FIRST YEAR STUDENTS ENROLLED IN A MEASUREMENT AND EVALUATION COURSE AT THE UNIVERSITY OF THE AZORES

by

Ermelindo Manuel Peixoto

B.A., University of Victoria, 1974

LIC. (equip) Universidades Portuguesas, 1976

A THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in the Faculty of Education

We accept this thesis as conforming to the required standard

[redacted]

John A. Downing, Ph.D.

[redacted]

John McLeish, Ph.D.

[redacted]

Loren Acker, Ph.D.

[redacted]

Geoffrey G. Hett, Ph.D.

Supervisor: Dr. John Downing

ABSTRACT

One hundred and forty-one student-teachers enrolled in a course in measurement and evaluation at the University of the Azores were assigned to three groups, comprising four different treatment conditions.

Groups I and III were assigned respectively to the mastery and nonmastery conditions. Group II, described in the study as a quasi-mastery group, received two treatments in succession. First, students in this group had sequenced instruction, based on structured learning hierarchies and unit tests, without provision for knowledge of results on the unit tests. Secondly, during the latter part of the experiment provision was made for feedback on the unit tests. In the group assigned to the nonmastery condition (III), there were two subgroups: those who received a pretest in advance of the instruction and those who were provided instruction but without a pretest.

There was a basic difference between students in the mastery and nonmastery groups (I and III). The former comprised first year students with no experience of university courses and testing procedures; the latter consisted of subjects who had already one or more education courses to their credit and who possessed some knowledge of the testing methods used in our study.

All groups received two achievement tests--Summative I in the middle of the instructional period and Summative II at the end. Students in Group II, who were exposed to two different treatment

conditions, received the same two tests: Summative I, which measured the effects of treatment #2, and Summative II which measured treatment #3 results.

Those subjects who received mastery instruction (first year) attained higher levels of achievement as a group than did those learning under the conventional method of lecture instruction (upper classmen). This was in spite of the fact that the course was at the third year level. Unlike the nonmastery group, these younger students had had no previous exposure to related courses and objective testing procedures.

Significant differences in levels of achievement were also revealed between the mastery students and the students in the first quasi-mastery treatment (unit tests without feedback). The first year students scored about the same as those assigned to the nonmastery condition.

However, when Group II subjects learned under treatment #3 (mastery method minus correctives) the group results were not significantly different from those obtained under the full mastery treatment (#1). However, Group II results under treatment #3 (tests only with feedback) were also not significantly different from those obtained by the nonmastery students.

Student performance was not significantly affected during the second part of the experiment when the unit tests were retained by the instructor once the relevant feedback/corrective measures had been accomplished. This was to ensure that subjects could not use these tests for study in preparation for the summative evaluation. Also,

there was no difference in student affect towards the relevant course materials between those learning for mastery in Group I and those learning under the partial mastery methods in Group II.

It may be concluded that the mastery method proved itself to be superior to the traditional method of lecture-discussion in increasing student achievement in this experimental study.

Examiners:

[redacted]

Dr. John Downing

[redacted]

Dr. John McLeish

[redacted]

Dr. Loren Acker

[redacted]

Dr. Geoffrey Hett

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the chairman of his advisory committee, Dr. John Downing, and to the other committee members, Drs. John McLeish, Loren Acker and Geoffrey Hett for their guidance and encouragement in the writing of this thesis. The thoughtful advice provided by Dr. John McLeish in the area of data analysis and interpretation of results was particularly valued by the author.

The author wishes also to express his gratitude to Sarah Baylow for the special efforts which she made that insured the completion of the typing of the thesis in good time.

To my wife Maria de Fátima goes my warm appreciation for her strong support and unfailing encouragement throughout my hours of study and writing for many months while we lived so far from home.

To my wife and parents

and to the people of the

Azores for whom this

research was undertaken.

CHAPTER I

INTRODUCTION AND NATURE OF THE PROBLEM

The present research aims at studying the effects of mastery criteria on the test performance of prospective teachers enrolled in a measurement and evaluation course at the University of the Azores during the 1980-81 academic year. It is true that there exists an abundance of high quality empirical evidence gathered mainly in North American institutions of higher learning designed to establish the very relationship which we seek to determine (Airasian, 1967; Born et al., 1972; Calhoun, 1976; Collins, 1969; Ferster, 1968; Gaynor & Wolkin, 1974; Gentile, 1970; Goldwater & Acker, 1975; Green, 1979; Mayo, 1968; Miller et al., 1974; Moore, Mahan & Ritts, 1969; Moore et al., 1973; Riedel, Harvey & LaFief, 1976; Semb, 1974; Tierney, 1973). But the effects of mastery learning strategies on the performance of university students have not been positively or negatively established in the Azores Islands to date, a fact which has reflected on the current status of mastery-oriented teacher education courses being presently attempted at the local university. Prospective teachers have had to infer the benefits of the mastery approach from the experience of others abroad as they, themselves, were never given the opportunity to profit fully from its unique features in the course of their formal university training.

For the University of the Azores the problem, thus, becomes one of providing a mastery performance experience for existing students so that they may experience first hand the general sense of adequacy

and self-fulfillment[1] associated with learning for mastery and, hence, identify with the merits of the mastery approach to the extent of becoming committed to it in a classroom situation of their own. To this extent, reaching beyond the mere replication of existing university level studies on the effects of mastery learning, our endeavour is to provide prospective teachers in the Azores with an alternative method to learning and instruction which they can experience directly in a real life situation and freely evaluate against conventional modes of learning and instruction in terms of their own personal experience. It is only incidental that the test performance of those who participate in this mastery performance experience shall be analyzed for statistical significance as part of a Master's thesis, but the coincidence might, nonetheless prove useful for participants should individual feelings of success and adequacy, as determined by course performance, be statistically corroborated at a convincing level of significance.

Attempting to introduce a mastery performance experience into the mainstream of conventional Portuguese higher learning is no easy task given the scholastic tradition of the expository lecture method[2] which still thrives on its high academic prestige. But should the University of the Azores wish to maintain its practical goal of preparing teachers to meet effectively the educational needs of the Islanders, irrespective of social status, the teaching of regular curricular courses by means other than the expository lecture method must be realized at least in the teacher training oriented departments such as that of education.

Recent political directives calling for the accommodation of students from all social strata in the mainstream of undifferentiated secondary school instruction (Sottomayor Cardia, 1976) can only be met

should existing classroom procedures be successful in providing for varying levels of student aptitude in the framework of regular, group-based instruction. And, should we be correct in assuming that teachers trained in the Azores are often uncommitted to the classroom use of learning procedures inconsistent with those which they may have personally experienced as students,[3] it follows that the University can hardly afford to despise such approaches to learning and instruction as criterion-referenced mastery, a method which tends to ensure increased learning irrespective of individual aptitude levels (Block, 1971, 1974).

Since our interest in providing a mastery performance experience to university students relates directly to the positive effect which it may have on the methodological preferences of future school teachers, we shall attempt to introduce the theoretical background to the mastery approach which we seek to devise for the aforementioned course in measurement and evaluation from the standpoint of current Azorean educational needs at the secondary school level. In doing so, we will be touching upon the broad issue of mainstreaming into common trunk education,[4] the benefits of which for the lower social classes in the Islands would probably be best realized should regular instruction allow for individual differences in the students' rate of learning and in their capacity to absorb skills and knowledge. To this extent, in a real and practical sense, the principles behind mastery learning cannot be economically dissociated from the overall context of learning and instruction in Azorean secondary schools where the distribution of student aptitude will probably become somewhat bimodal as mass education is achieved at the post-primary level. As such, it would be most

reasonable and scientific to build the case for the application of mastery criteria to learning and instruction in the Azores from the standpoint of the very curricular level to which the approach seems most relevant and useful.

Consistent with this orientation, it now remains for us to expound the merits of criterion-referenced mastery for achieving the successful integration of students of different socio-economic backgrounds, previously subject to discriminatory post-primary educational options[5] (Sottomayor Cardia, 1976; Grácio, 1973, Cruzeiro & Antunes, 1978), into the mainstream of an equal opportunity, unified system of secondary school instruction. However, before we do so, it would be useful to trace the socio-political nature of the very educational needs which we are now attempting to meet through the use of mastery learning procedures. Only then can we attempt to build the kind of theoretical rationale needed to justify the classroom implementation of mastery learning strategies of the type that we shall illustrate for the measurement and evaluation course.

The Socio-Political Nature of Azorean Educational Needs[6]

The Azores Islands,[7] administratively part of Portugal for over five hundred years, have been subjected all along to the Portuguese educational system which, until recently, functioned in an elitist fashion and was thus most insensitive to the educational needs of the lower social classes (Grácio, 1973; Cruzeiro & Antunes, 1978; Mónica, 1978; Valente, 1974).

From the historical perspective, to concentrate on the selective nature of Portuguese education is to recognize that it has served to perpetuate the power of the dominant classes by catering exclusively to their interests and designs irrespective of prevailing social and political circumstances. The long-term result for Portuguese society has been the institutionalization of a socially differentiated system of instruction which survived the strongest of nineteenth century liberal winds of change and lasted well into the present century.

Not that genuine efforts failed to be made at specific times in order to ensure that no educational system came to survive the very circumstances which originally determined its creation. Alexandre Herculano, the outspoken classic liberal on matters of education, had shown as much by addressing the educational concerns of his day in the overall context of the establishment of a new bourgeois order. Writing as early as 1838, Herculano had actually called for the eradication of existing absolutist pedagogical institutions and sought to introduce an elementary school oriented system of mass education as an expression of the democratic attitude of Liberalism. New pedagogical institutions would therefore contradict the very philosophical foundations of established absolutist practice by aiming at the creation of an informed and competent citizenry capable of manifesting sound principles of "collective morality" and "material prosperity" and of undertaking, at the same time, their share of civic responsibilities in a manner consistent with the survival of the newly installed constitutional monarchy (Valente, 1974). However, even if subsequent liberal governments, as political instruments of the middle class, sought to legislate

in favour of extended educational opportunities for the masses of the people, it remained clear by 1900 that whatever efforts had been made in the course of fifty years to rejuvenate the Portuguese educational system had ended in failure. Lack of money coupled with the apparent inability of the small and isolated liberal ruling class to shake the indifference of the masses towards the value of education determined the final outcome of Herculano's mass education project (Valente, 1974).

And so, the prevailing 19th century view that without the institutionalization of mass education, society was, in its submission and ignorance, highly susceptible to tyrannical forms of government (Valente, 1974) came through for Portugal at least in the form of a benevolent, national dictatorship[8] which, once installed, sought to challenge the concept of public education set forth by contemporary 19th century Portuguese reformers (Valente, 1974).[9]

Bourgeois Education in its Ultimate Expression

The concept of mass education lost in preference to a selective public education system aimed at providing mainly post-primary instruction of quality to a specific class, referred to, "according to prevailing circumstances, as the middle class, the ruling class or the bourgeois" (Valente, 1974, p. 167). Much in the same way as before, education continued to be thought of as the best way of assuring the economic and cultural prosperity of the nation. But whilst the classic liberals thought that such prosperity could only be achieved once the masses of the people were freed from ignorance, the men of the national dictatorship preferred to concentrate on the education of an elite for sound and effective leadership for, in their view, longstanding

bureaucratic parasitism had been hindering economic and social progress by depriving national production of skilled technicians and qualified administrators. To men such as Agostinho de Campos, higher learning in Portugal, having "degenerated into oratory and bookishness . . . [to the point of] . . . betraying its character as well as its objectives,"[10] merely served to foster a sterile and economically inviable "baccalaureate vice", itself responsible for the existence of a needlessly large government bureaucracy (Valente, 1974).

By the end of the 19th century it thus remained clear that the solution for Portuguese socio-economic and institutional underdevelopment was to be found, at least for the time being, in provisions for material progress through industrialization, for economic growth was regarded by the regime as the necessary condition for future democracy. Emphasis was therefore to be placed on the education of a new elite capable of running a modern economy and of acting as "external agents"[11] for the eventual education of the people whose lack of immediate instruction, it was felt, would not affect short-term national priorities. In the urgency of the industrialization process, the average illiterate could well be left alone for he already possessed the attributes that were most required of him: physical strength, sense of duty, ability to work from dawn to dusk and promptness in meeting the heavy tax burden.[12]

Provisions for an effective public system of mass education would have been virtually impossible for lack of appropriation funds, the availability of which is no doubt proportional to the state of economic development attained by a given time. Nevertheless, no effort was

made by the men of the dictatorship to conceal the socially discriminatory nature of their educational project. Its very principles were in fact derived from the preconceived notion that existing national decadence, being attributable to the inadequate education and the exploitative attitudes of the middle class, could simply not be blamed on illiteracy. But then if the masses were not as ignorant, it could be argued that the common person would not have been as easily missled by the ruling class, an assertion that in the classic liberal perspective would spell the difference between success and failure at the rejuvenation of society.

To such deviant views, Agostinho de Compos, the spokesman for the dictatorship in matters of education, would simply answer that, at that particular point in time, the system of primary education best able to meet the needs of the country was not that which taught the masses of the people to read and write but that which taught them "how to avoid the dangers of knowing how to read".[13] By concentrating mainly on teaching the masses to read, primary instruction was seen to constitute a mere means towards a much broader formative end--education per se--and, as such, reading knowledge alone would only serve to expose the person to political and anarchical exploitation (Valente, 1974).

Socially Differentiated Education in the 20th Century

To the detriment of the nation, such anachronistic ideas regarding the public education of the masses were to prevail in Portugal for the better part of the present century.[14] In effect, the mentor of the dictatorial regime installed in the wake of the 1926 *coup de etat*, which ended sixteen years of democratic government under the Republic

and subjected the country to strict paternalistic rule for forty-eight years, went beyond de Campos' concept of delayed mass-education to suggest that the Portuguese people was simply not motivated to learn (Mónica, 1978). And the rationale for so believing was simple: rural schools are empty because the citizenry, "in its intuitive wealth . . . does not see the need to learn to read".[15] This meant, in politico-ideologic terms, that the 19th (and early 20th) century liberal tradition of equality among men was being shelved and substituted by a sort of Christian philosophy of power, itself the product of Mussolinian fascism mixed with elements of the social doctrine of the Church (Mónica, 1978). Such orientation, as will be demonstrated, reflected itself heavily on the social role of the primary school in the decades following the 1926 *coup de etat*.

To the idealogues of the new conservative order, the 70% illiteracy rate which plagued the country in 1930 (Mónica, 1978) was unavoidable because it was extremely difficult, if not impossible, to break the vicious cycle resulting from utterly ignorant rural environments breeding further ignorance and apathy by their sheer influence on the people.[16] Much in the same way as before, educational priorities were being placed on the effective preparation of a select group for leadership: "It is . . . more important to create vast elites than to make the people literate . . . because the issues of concern to the nation will have to be resolved, not by the people, but the the elites with the cooperation of the people."[17] This is to say that education should not be considered as an individual right, but rather as a matter of necessity for the regime[18] which, clearly, sought to use it as a tool for social control, especially at the lower levels. Whatever elementary

type instruction was allowed to exist had to conform first of all with government endeavours for school-initiated moral and political indoctrination, a process which was to take precedence over efforts aimed at providing the most rudimentary of literary skills to the people (Mónica, 1978). Such philosophy probably served to further degrade the already precarious state of rural elementary instruction in that the primary school, "as the most dilligent and disciplined of state security forces",[19] would best serve its function in the urban areas where the potential "political subversives" were clustered.[20]

Ever mindful of the fact that its very existence depended, to a great extent, on the indifference of an ignorant peasantry, the dictatorial regime openly advocated the advantages of illiteracy even if the dominant classes may have been divided (just as they had been in England a century earlier) about the possible attributes of illiteracy (Mónica, 1978). Using the same line of reasoning adopted by the president of the English Royal society to challenge the 1807 law on the introduction of elementary schools in England, people such as Virginia de Castro e Almeida held that literacy hindered the happiness of the common person, provided for the acquisition of bad reading habits and distorted political views and was susceptible of bringing about material ambitions unbecoming of the lower social conditions (Mónica, 1978). According to Virginia Almeida, "the strongest, most beautiful and healthiest side of the Portuguese soul is that which resides in the 75 percent of . . . [the country's] . . . illiterates."[21]

Whatever debate may have ensued over the convenience (or lack thereof) of providing for a country-wide mass literacy programme, and

however much the regime may or may not have conveyed the intention of creating such a programme, the fact remains that basic primary instruction, which until the 1950s could well be regarded as the sole means for eradicating illiteracy in the country,[22] was all but ridiculed. In effect, the educational ideas which prevailed in the country for the better part of forty years "may be expressed . . . as the concomitant reduction of the number of years of compulsory schooling and of the number of subjects to be taught at the elementary school level" (Mónica, 1978, p. 282). With the justification that the government must reduce public expenditure and take precautions against a population explosion in the lyceums, the regime undertook to reduce compulsory primary instruction first by one year, in 1927, and then by a further year a decade later (Mónica, 1978; Melo & Benavente, 1978).[23] Also, in the words of Mónica (1978), within ten years of the original reduction in the duration of primary studies, "the school curriculum was limited to the traditional subjects of the seventeen hundreds: reading, writing and arithmetic" (p. 282).

Different Schools for Different People

One of the regime's measures which most affected the standards of performance and the reliability of public primary education in Portugal was perhaps the creation of a second-rate system of elementary instruction (*postos de ensino*) aimed at providing low-cost education for the children of the smaller, most isolated regions of the country. Staffed by unqualified teachers, whose certified "moral and intellectual integrity"[24] sufficed in most instances to assure them of a position, the *postos de ensino* were in to stay by 1931 (Mónica, 1978). Their

ever-increasing presence[25] as an underrated substitute for the regular schools only served to lower the already deficient and negligible yearly output of the primary schools[26] and further degraded the image of the elementary teaching profession.

Teacher training, once uppermost in the minds of educators, suffered two successive reductions in curricular load (1930 and 1936) and strict controls were imposed on admissions to the extent that all registration was eventually cancelled for a period of six years beginning in 1936.[27] Not only were there many schools closed for lack of teachers (Mónica, 1978)--just as others had been in 1926 for failure to meet stipulated levels of enrolment[28]--but the quality of training provided after 1943 had also deteriorated. Aside from arithmetic and reading methods, little more than a miscellanea of official doctrines, heavily dosed in religion, was allowed into the curriculum. In effect, such orientation constituted one of the best educational symbols of the regime for, at the classroom level, it would guarantee the desired inculcation of non-cognitive traits over the teaching of cognitive skills. As an agent of social control, the primary school did not exist to stimulate the child's intelligence in an analytical and creative way. It did exist for ethical ends: to teach good morals and to suppress the child's "natural tendencies for indolence, boldness, hypocrisy and rebellion" (Mónica, 1978, p. 314) through strict classroom discipline. Only in <u>educating</u> modest and obedient citizens could the regime enhance its chances for survival. Such concern perhaps determined the lack of encouragement for in-service teacher education programmes and led to repeated reminders to teachers that their job

was not to "rejuvenate the world but merely to maintain discipline" (Mónica, 1978, p. 177)--just as they had been trained to do.[29]

Teachers were merely trained to teach the catechism[30] and provide basic notions of reading, writing, and arithmetic to their students. Their teaching methods were reminiscent of those of the middle ages, the object being not to foster nor reward intellectual excellence[31] but rather to fill the student's mind with already discovered knowledge, much in the same way as one fills an empty slate. Rousseau's naturalistic conceptions had been defeated. "The alleged liberty of the child [it was held] did not exist except in the subservise minds of the idealogues" (Mónica, 1978, p. 308). As such, just "as plants are shaped through farming care, by watering, trimming, fertilizing and propping as a means of straightening their stalks and giving them protection against the wind [and of] twisting those branches which are growing in the wrong direction, so must the process of human education be achieved."[32] Socialized for obedience and resigned to strict passiveness, the child enjoyed no freedom of movement or initiative, spending most of his school time listening to extenuating lessons and engaging in repetition drills which, as Mónica (1978) suggests, probably constituted an "excellent means of self-discipline" (p. 323) in view of their boring nature. In effect, the proper education of submissive and humble citizens could only be achieved through the kind of school environment most susceptible of creating stereotyped individuals incapable of asserting their will for fear of recrimination.[33]

Causes Underlying the Survival of Socially Differentiated Education

It remains clear that the democratic ideals which prevailed in Portugal during the years of the First Republic, from 1910 to 1925, had little influence over educational policy in subsequent decades. This was so because prevailing social and political circumstances rendered the democratic system of government installed a failure and brought about a retrograde dictatorial regime which, as a matter of survival, openly sought to make ignorance the rule, not the exception. Having triumphed over the monarchy in 1910, the Republic had been in the position of upholding its democratic principles and of creating new institutions for the country in consistency with those created elsewhere. Yet, the republicans found themselves in the same uncomfortable position as the classic liberals had been--isolated before ignorant masses whose inertia and lack of commitment they must overcome through adequate education as a means of assuring the survival of their new policies (Valente, 1974).

In effect, only a solid system of elementary school instruction directed at the masses of the people could eventually check deep-rooted attitudes of submissiveness and docility and allow for the education of active and responsible citizens capable of exercising their civic responsibilities and of engaging in personally rewarding occupations.[34] In the Republican view, it made no sense to capitalize on the elitist education of the ruling class when the masses of the people remained ignorant and unresponsive to any form of social and political change. Political change through participatory democracy was thought to be the necessary condition for economic and social progress. In this sense, the achievement of a new socio-political order was to be made

contingent upon the widening of the period of compulsory school attendance, under which a broader elementary curriculum would be instituted, and upon the introduction of naturalistic pedagogical principles capable of assisting in the natural and spontaneous development of each child's personality (Valente, 1974).[35] Such measures, according to Republican conceptions, would suffice to assure "the moral and intellectual" independence of the country as they would serve to contradict passive subservience and lassitude, creating instead individualistic and responsible citizens capable of tranforming their environment in the most positive of ways.[36]

But, much in the same way as the political revolution, the Republican educational revolution was destined to fail. As Valente (1974) points out, "only through the example set by its supporting institutions may the democratic state hope to influence the ideas and the habits of the community, and such contamination process is necessarily long and aleatory, i.e., it is certainly not revolutionary" (p. 212). Also, as Mónica (1978) would argue, in an ignorant, illiterate society ignorance does not in effect constitute a disadvantage. Within a society which continued unchanged along traditional lines, mass schooling would not immediately translate into generalized prospects for social mobility or for increased standards of living, there being no need to attain literacy status as a means of bettering one's material condition within the limited space of the home environment.[37] The economy of the country, which remained essentially unchanged at the subsistence level, failed to produce "radical changes in the state of awareness of individuals" to the point of influencing their attitudes

towards primary instruction.[38] And, aside from the prevailing socio-economic conditions--which made it necessary for the parent to weigh the possible benefits of sending his child to school against the loss in family revenue generated by the child's absence from farm labour (Mónica, 1978)--the government simply did not have the money, nor the qualified human resources, to institute such an ambitious mass education scheme on a country-wide basis (Valente, 1974).

To state the factors which contributed to the failure of the Republican mass education project is to realize that, by 1926, the year in which political freedom was lost to authoritarian rule, the attitude of the masses of the people towards education still translated into sheer neglect and indifference. Such attitudes no doubt minimized the social repercussions of any sudden change in educational policy but, most important in terms of future educational orientation, they suggested the existence of an accepted and deep-rooted condition of inferiority[39] which was taken advantage of in the most unfortunate ways.

Towards the Instillment of Stereotyped Feelings of Inadequacy and Subservience in the Masses

In effect, the person of lower social condition came to be regarded as intellectually inferior in ability and potential, the notion that their impairment was congenital rather than environmentally induced being cleverly conveyed by the new breed of post 1926 authoritarian idealogues in their quest to further instill in the masses of the people stereotyped feelings of inadequacy and unquestioned subservience. Basing themselves on a rather curious theory regarding the origins of intelligence, people such as Marcello Caetano[40] held

that social factors played a decisive role in intellectual development and, merit and social status being entirely related, the prolonged mental exercise required for effective thinking demanded the kind of preparation that the lower classes simply did not possess (Mónica, 1978). To Caetano, inherent difference in intellectual ability did occur and were socially determined since "the ideas, the notions, the experiences develop themselves over generations to the point of flourishing at a given time in the person of one of the lineage descendents."[41] As such, the descendent of a laborer selected perchance by his teacher to study the sciences, would forever remain a "mediocre intellectual" as he would be engaging in subject matter for which he had not been hereditarily prepared. Such a person might at best become a knowledgeable man, but one who would prove incapable of adjusting to the new life that was arbitrarily cut out for him.[42] In effect, "an intelligent child, born of a capable and honest laborer, may, in his father's profession, become a skilled, progressive and appreciated worker and may even be considered among the elite in his [particular] profession,"[43] but this would be the extent of his social mobility. As Mónica (1978) states, "each class had its internal hierarchy, within the bounds of which merit counted . . . [but in any] . . . broader sense . . . status was [necessarily] inherited" (p. 137).

The newspaper Diario de Noticias[44] even published the "scientific base" for this new theory on the origins of intelligence as conveyed by the minister of public instruction, Eusébio Tamagnini. The minister had actually divided the intellectual aptitude of the Portuguese elementary school population into five broad categories

claiming that Terman, an American psychologist, had shown that mental aptitude varied in consistency with the Caetano point of view. In this sense, the democratic ideals preached by the republican educators could only be based on contradictory and biologically false premises and, as such, equal opportunity mass education made no sense (Mónica, 1978).

In more recent times, even the much proclaimed educational reforms of the late 1960s (although widely publicized and at times overblown in range and importance in order to meet foreign criticism of Portugal's backward and tendentious educational system) failed to provide equal opportunity access to the development of what Rogers (1979) termed the four fundamental abilities, namely "to think effectively, to communicate thought, to make relevant judgements and to discriminate among values" (p. 73).

Education in Recent Decades: The Maintenance of Vertical Structures

Until the late 1960s, most of what had been achieved in terms of pedagogical reform may be summed up in the few measures aimed at reinstituting the four year compulsory school system,[45] first instituded in 1927 and cut by one year a decade later, and at providing the system with more adequate physical and human resources as a means of meeting the effective increase which occurred in the primary school population over the past thirty years.[46] Primary teachers, for the most part, continued to be confronted with substandard physical and recreational facilities and were subject to the inadequacies of a textbook controlled curriculum[47] as well as to the less than responsible intervention of many school officials. And they mostly dealt with

socially deprived children whose adequate education would have been a challenge even to the best equipped of school systems.[48] The average child, on the other hand, had to make do, at the basic education level, with the rudiments of reading, writing and arithmetic and, in most instances, the period of compulsory primary instruction continued to determine the extent of his/her formal education. Notwithstanding greater demands for post-primary education, secondary level studies remained optional and socially differentiated with no alarming increases being registered in the overall secondary school population.[49]

Important educational reforms were no doubt introduced in 1968, but, as suggested, they too failed to provide for the creation of a single, socially undifferentiated system of instruction. Minister Veiga Simão did in fact bring Portugal a step closer to the rest of Europe by extending the period of compulsory school attendance to six years and by relaxing secondary school admission barriers and financial restrictions on the poor. However, generalized access to equal opportunity education, better adjusted to a long overdue necessity for the creation of democratic institutions, continued to be socially determined (Grácio, 1973). The added two years of mandatory studies under the Veiga Simão reform in effect failed to create a single six year elementary school system accessible to all students, without distinction,[50] and capitalized instead on a scheme "defined [at the fifth and sixt grade levels] by [two] parallel branches of instruction of unequal social prestige and different pedagogical content" (Grácio, 1973, p. 24).[51] Of two possible options, one was offered within the

elementary school system to students not ascribing to further education and the other, a separate and autonomous system, aimed at preparing students for secondary level studies (Grácio, 1973).[52]

The discriminating nature of Veiga Simão's scheme, however, reached beyond inbuilt provisions for socially differentiated instruction in the final phase of the period of compulsory education. Leaving the old Portuguese secondary school system untouched in the essence of its basic structure,[53] the reform equally failed to eradicate the social stigma traditionally attached to the two main institutions of secondary learning: the academically prestigious lyceum and the more modest and lower class related technical school. Both institutions in fact continued to exist and function as a vertical structure in the socially differentiated secondary school system. Research conducted as late as 1975 (Cruzeiro & Antunes, 1978) clearly indicates that at that time consistent differences remained evident in the social origins of the students attending the lyceums and the technical schools for the sample studied. Students attending the lyceums more often descended from superior socio-economic and cultural extracts than did students attending the technical schools.

The existence of different schools for different people confirms, as suggested, the hierarchical nature of Portuguese society and clearly points to the fact that students of lower socio-economic condition were far more susceptible of engaging in school experience of lesser curricular status and more limited occupational perspectives than were their counterparts who belonged to the higher social brackets. Divisions within the social hierarchy were in turn strengthened by

the above related difficulty of access to equal opportunity education. The resulting vicious cycle no doubt proved difficult to break.

But, most important for the purposes of the present study is the startling conclusion that, by 1974, less than a decade ago, the Portuguese educational system had at best succeeded in bringing the number of elementary school students closer to European standards. However, attendance at the secondary school level, having remained socially determined and exceptionally low according to European indexes, reflects the failure of the system to provide mass education to the Portuguese adolescent population and, thus, bridge the gap between the normal school leaving age and the beginning of active life which, in the more developed countries, seldomly occurs before sixteen or eighteen years of age (Grácio, 1973).

Being subject to the tight reins of an authoritarian and overly centralized political system, education in the Azores constituted no exception to the Portuguese rule, the end result, seventy-four years into the present century, being the existence of a school age population affected by profound differences in aptitude and capacity to absorb skills and knowledge.[54] Unequal educational opportunities and environmental stimulation of varying degree and quality stood to complicate the effective accommodation of students of different socio-economic backgrounds in the mainstream of undifferentiated secondary school instruction.

The Advent of Political Freedom: Drive Towards Equal Opportunity Education of Horizontal Structure

With the advent of political freedom in April, 1974, a genuine and ambitious effort was pledged, both in the Portuguese mainland and in the newly autonomous regions of the Azores and the Madeiras, to elevate the socio-economic conditions of the masses. Social mobility and increased standards of living, as indexes of socio-economic betterment, were thought attainable through equal opportunity education for students at all levels of learning, irrespective of social status, and through intervention measures aimed at raising the cultural and intellectual levels of the socially deprived home by means of family involvement in literacy campaigns and in cultural and civic education programmes.[55]

Obviously, the institution of an equal opportunity system of mass instruction would require not only the elimination of different educational options at the compulsory school level, but also that secondary school attendance be brought up to existing European standards. Still, provisions for the effective enrolment of all students in the mainstream of common trunk instruction did not, on the other hand, necessarily translate into generalized prospects for democratic education. The Veiga Simão experience had shown all too well that to make education democratic is not necessarily to make it accessible to all. It equally showed that, at times, generalized access to education may even stand to reinforce longstanding social privileges especially when the educational system is characterized by vertical structures and when social assistance, in the form of bursaries and of transportation and

room-and-board subsidies, fails to bring social justice to education (Grácio, 1973).[56]

It was clear that within the main area of concern of the present study, the secondary school sector, simple integration would not suffice to reduce the longstanding difference, in "attitudes, habits, conceptual and linguistic resources, standards of culture . . . [and] . . . values" (Grácio, 1974, p. 19) which remained apparent across the Portuguese social strata in the most recent years. Hence, further to the above related need for decisive measures of intervention capable of sparking a long process of aculturation, "the discriminatory effect of social determinisms in the mental capacities of . . . [students] . . . (aptitude and interests, inclusive)" (Grácio, 1973, p. 19) had to be checked from the start through adequate educational reform (Sottomayor Cardia, 1976; Caderno PPD-3). And the need for reform was all the more urgent in that "criteria for school success or failure . . . [being] . . . socially determined . . . [operates as a] . . . function of how closely one can match the attitudes, the habits and the cultural peculiarities of certain social extracts as well as the demands of the school system which they have created" (Grácio, 1973, p. 19).

Still, notwithstanding the fact that the cultural content of the lyceums must change from an "hibrid composition of classical traditions and encyclopedic positivism" (Grácio, 1973, p. 29) and capitalize on the relaxation of selective capacities for language expression and thought, education in today's world is a formative affair no less reliant on forms of verbal competence and cumulative cognitive processes. In this sense, the demands of the school curriculum could hardly be

relaxed as a means of meeting, say, the progressively lower levels of verbal readiness (Ausubel, 1964) of students who had been subjected to less than adequate environmental stimulation in the course of their formative years. Since a sizeable part of the secondary school population in the Azores is bound to be made up of such students,[57] the implication of adjusting the school curriculum to meet their specific needs would negatively reflect on the overall academic standard of the secondary school system which would now fail to fully promote those intellectual skills that are internationally recognized as appropriate for the secondary grades.

Also, should curricular content and achievement standards be lowered to the entering levels of readiness of the lower social class students, the resulting deficit in the stimulating potential of the regular school environment would necessarily affect the rate of cognitive growth of the more capable students who, theoretically, would have to keep pace with their slower moving counterparts. Such relaxation of curricular demands could also have the added effect of provoking a brain drain in the Islands by anticipating the already established trend of sending the more promising university students abroad for their education, the odds being that few will ever return to their place of origin. To this extent, it seems likely that no government would ever sanction the practice of deflating academic standards across an entire system just to accommodate the immediate readiness of a given social extract, no matter how sizeable such a group may be in the context of the overall school population.

From the political standpoint, it appears as if the most acceptable solution to the problem of integrating lower social class students

into the mainstream of socially undifferentiated instruction resides in the possible elevation of individual levels of readiness to the system's standards of entering competence. In his address of October 28, 1976, Minister of Education Mário de Sottomayor Cardia was stating as much by recognizing that only an adequate system of preschool education could stand to eventually correct the inequalities resulting from profound socio-economic differences still existing among Portuguese families. Cardia's opinions were equally shared by his political opposition in the Partido Social Democrático (Caderno PPD-3) and scientifically confirmed by the University of Coimbra professor Emile Planchard who provided the psychological and pedagogical reasons why preschool education for children of between three and six years of age should be instituted:[58]

> [The need for preschool education is all the more] imperative in Portugal where, for a large proportion of the inhabitants, the standard of living is low and the home environment little favourable or even contrary to a sound education. . . . It has been widely proven that children who have attended preschool classes develop faster than students who have not done so. The child acquires . . . during this preparatory phase, the sense of discipline, the ability to interact socially, a more correct and uninhibited use of his mother language, a greater awareness of his surrounding environment, a tuning of his sensory aptitudes, etc. (Grácio, 1973)[59]

Even though Sottomayor Cardia stopped short of announcing the creation of a country wide system of public preschool education in 1976[60] (perhaps due to legislative, financial and human resources restrictions) what remains of importance is the very essence of this socially equalizing policy which aimed at the correction of basic differences in aptitude from the outset.

Still, however much Cardia's assertions regarding preschool education may constitute the eventual answer to Portuguese educational

problems, consistency with the earlier related considerations favouring the maintenance of the secondary school curriculum to accepted standard would demand the here and now actualization of deficient levels of readiness in the regular classroom setting. The effort would no doubt look good to the world given the present distribution of aptitudes[61] among the Portuguese school population and it would equally satisfy the internal demands of the different social classes, presuming that the upper classes were of late more receptive to universally proclaimed equal opportunity education. Also, officials could hardly be accused of any desire to perpetuate the intellectual status-quo of the lower social status students since, under this conception, curricular planning would adhere to the standard of education universally recognized as appropriate for the specific age levels of the students involved.

For the socially handicapped secondary school student, inclass provisions for the actualization of prevailing intellectual deficits would be ultimately judged by their overall effectiveness in promoting the operational levels of readiness most consistent with the demands of the instituted school curriculum. Obviously, taking into account the entering readiness of lower social status students would initially demand the outright elimination of all subject matter that they cannot economically assimilate on the basis of their ongoing levels of cognitive sophistication. But, this simplification process would only occur to the extent that it may be necessary to individually prepare these students to adequately cope with the kind of subject matter prescribed for a given grade in accordance with universally recognized standards of performance.

That equal opportunity education, based on the premise of single standard, common trunk instruction, was to be achieved by maintaining the stimulating potential of the learning environment at the full developmental level is perhaps best reflected in the actual creation of a unified system of secondary school instruction in 1976 (Sottomayor Cardia, 1976). Under this new system of instruction, a common core of mandatory studies is undertaken by all students irrespective of origin or of programme of studies being followed[62] and a more advanced cycle of instruction allowing for the pursuit of revealed interests in the academic or vocational fields permits each pupil to build upon his/her commonly acquired foundation of learning in a manner most consistent with his/her personal endeavours.[63] Such a system, similar in nature to that which Grácio (1973) had proposed sometime before, allows for a smooth, horizontal transition from one area of complementary studies to another, should the pupil choose to make such a change, and concentrates all the different options available to the student within the confines of a single institution.

Going this route was a challenge to both the educator and the educational system for maintaining the instituted curriculum to standard in the Azores required special provisions for the adoption of instructional methods capable of preparing students of lesser ability to deal with the mainstream of group-based instruction. But notwithstanding the foreseeable problems, some of which no doubt led to Memorando L/T/ED-52/79 of July 1979, from the Director-General of secondary instruction, requiring that secondary schools allow for individualized courses of instruction and learning correctives as a

means of curbing embarassing rates of insuccess, the fact remains that, apart from any genuine desire by officials to personally introduce equal opportunity education, they were compelled to do so politically. The slightest of deviations from this concept of education would have resulted in accusations of intellectual snobbery and in charges to the effect that officials remained convinced of the inherent ineducability of lower class children. Furthermore, any attempts to provide alternative options of studies at the secondary school level, besides being impractical at this point from the operational standpoint, would have beed construed as an attempt to reinstitute a double, class-oriented standard of education in the country.

Weighing the Merits of Criterion-Referenced Mastery on Azorean Secondary School Requirements

In consistency with the position outlined above, we now propose to weigh the merits of criterion-referenced mastery on Azorean secondary school requirements for group based quality instruction capable of allowing for individual differences in both the rate of learning and the intellectual capacity of students. In doing so, we realize that the success of any instructional strategy devised to meet the learning deficiencies of students of lower aptitude is ultimately determined by the extent to which the system may be successful in creating a genuine atmosphere of trust and commitment both at home and in the classroom so that teachers may readily gain the credibility of parents and serve as effective motivating models for their students. And we would even concur with the notion that only a radical change in parent

outlook towards the value of education in general can effectively assure the ultimate success of the lower social class student's educational experience by facilitating the early introduction of preventive measures capable of actualizing environmentally induced learning deficits at earlier stages of ontogenic development (Ausubel, 1964).

However, choosing to deal with the education of lower social status students at the regular classroom level through adequate instructional methods is not to underscore the vital importance of longer term, community-oriented efforts falling within the realms of prevention and intervention. It is merely a way of recognizing that the integration of slower achieving students into the mainstream of Azorean secondary school learning is a consummated fact of sudden occurrence, the fragile nature of which demands that first priority be given to the enaction of instructional measures capable of rendering the outlined integrative effort feasible on an immediate term basis.

Should the intellectual deficits prevailing among lower class students be environmentally induced,[64] at least to the extent that lack of adequate stimulation may hinder the proper development of the intellect to its genetically determined potential, it is rather likely that the enaction of optimal instructional measures in the normal classroom setting will suffice to actualize social class related deficiencies in functional capacity provided that each student is properly motivated to learn. It could be argued that socially handicapped students, by virtue of their environmentally induced deficit in functional capacity, would be far less able to profit developmentally

from more sophisticated forms of environmental stimulation, as an individual's prior success or failure in developing his/her cognitive capacities tends to maintain his/her subsequent rate of growth fairly constant (Ausubel, 1964).

There is also empirical evidence to suggest that individuals become less sensitive to stimulation in areas of minimal development as they progress through and transpose the primary, undifferentiated state of intelligence (Havighurst, 1944; Janke, 1945). Such a finding would suggest that once a student incurs an environmentally induced deficit, say in verbal skills, he/she might experience considerable difficulty in meeting instituted curricular demands as his/her intelligence would have been specifically committeed in other directions.

However, it should be remembered that, when properly motivated, humans are capable of learning at times other than those coinciding with allegedly optimal periods of ontogenic readiness when the organism is supposedly, in terms of its actualizing potential, most susceptible to the precise stimulation which triggers such learning. In effect, whenever levels of sophistication relative to a given learning task remained the same for children and adults, the latter held a sizeable edge over the former in learning such a task (Ausubel, 1964). This is to say that if growth does in fact stem from an already actualized capacity and is therefore cumulative rather than sequenced through the occurrence of brief periods of optimal readiness, it should somehow be possible to actualize those deficient functional capacities which stand in the way of full intellectual development, despite the degree of severeness of the cognitive impairments or the direction in which the student's intelligence might have developed. From the standpoint of

classroom learning and instruction, it appears as if deficient functional capacities may be best actualized through experiences of success derived from individually stimulating learning environments where the presentation of subject matter can be made contingent upon prevailing levels of cognitive readiness and the task progression of each student determined by rate and time factors that allow for the expression of individual differences in learning ability. Efficient learning would no doubt render the socially handicapped child's classroom experience cognitively fruitful, but its greatest asset, in this context, is affective in nature given the emotional and motivational consequences of school failure as determined by prolonged environmental deprivation.

That optimal learning environments have a significant effect on the intellectual development of long-deprived preadolescents and adolescents may not be well supported by empirical evidence at this time, but Ausubel (1964) cites evidence which suggests that the placement of children from less stimulating orphanages in more varied and diversified environments has tended to raise their IQ levels. Further cited in this context is Kirk (1958), who reports that intensive preschool training does in fact improve the IQ and the educability of the endogenously mentally retarded. As such, providing secondary school students of lower social status with adequately stimulating optimal learning environments, capable of catering to their prevailing levels of readiness and to the rate at which each student best learns, is probably the most effective way of actualizing intellectual deficits, especially as one considers the effects of initial success on subsequent endeavours for achievement.

It appears, at this point, that the education of intellectually impaired lower social status students could be best achieved through self-paced individualized approaches to instruction since individuals who experienced intellectual deficits induced by past environmental deprivation do not possess the repertoire of knowledge and sophistication capable of providing for efficient learning in the context of conventional, group-based instruction. However, in the case of the Azores Islands, requirements for the integration of students of lesser ability into the mainstream of secondary school instruction render the above prescribed self-paced approach to learning impractical since the amount of time required for learning is relatively fixed in the conventional classroom setting. In this sense, what is required is a teacher-paced approach to learning and instruction allowing for the accommodation of varying levels of student aptitude within the framework of group instruction. Being sensitive to student aptitude, this teacher-paced approach to learning must equally emphasize instruction of optimal quality per learner and be sensitive to the rate at which rather than the level to which a given student might necessarily learn the appropriate subject matter. However, in this case, the manipulation of the instructional variables of <u>required learning time</u> and <u>quality of instruction</u> for each student has to be achieved in the context of group-based instruction and, thus, be subject to the regimentation effects of structured time.

Empirical evidence, yet to be cited, makes a strong case for the effectiveness of Benjamin Bloom's mastery learning strategy as a means of providing group-based instruction of optimal quality per learner.

In essence, by assuming that aptitudes for learning are predictive of the rate at which the student is capable of learning, Bloom's approach emphasizes criterion-referenced mastery for the prescribed learning tasks and manipulates certain relevant instructional variables so that the stipulated mastery criteria may in fact be met by the majority of students irrespective of their entering levels of aptitude.[65] As such, even in typical group settings, little or no relationship would be likely to exist between aptitude and achievement as each learner would receive optimal quality of instruction and the learning time he/she required (Block, 1971). Thus, under this conception, students who learn at a slower rate can be made to experience levels of achievement comparable with those of 'learning sophisticates' whose capacity for absorbing skills and knowledge is obviously much greater. In this sense, mastery learning, applied in instances where students are normally distributed with respect to attitude, stands to contradict typical classroom results which show a rather significant relationship between aptitude and achievement. Such an outcome may well be the result of the effective manipulation of the instructional variables identified in John Carroll's Model of School Learning (1963) as facilitated by inbuilt provisions for supplementary instructional correctives and qualitative feedback devices--two strong distinguishing characteristics of the mastery approach.

But the effectiveness of Bloom's mastery strategy in providing a successful academic experience to students of varying aptitude levels will be ultimately determined by its ability to allow each student the amount of time he needs to effectively learn to the set criterion in

the course of formal, group-based instruction. As John Carroll (1971) points out, citing J.P. Guilford's work on the "structure of the intellect", learning time for a given task is a rather complex function of basic aptitudes such as verbal competence, memory ability and, among others, spatial ability, a lack of which is often found among students of lower ability creating, thereby, an urgency for the inclusion of the learning time factor as a primary instructional variable whenever the education of pupils of varying ability and social class background is a consideration.

Provisions for a Flexible Time Component .

Bloom's mastery learning strategy is generally thought capable of allowing for the manipulation of the instructional variable of learning time even if it stops short of being a truly individualized approach to instruction (Block, 1971, 1974). Bloom's approach, in effect, evolved from a model of learning which manipulates such fulcral instructional variables as student aptitude, quality of instruction and ability to understand instruction in the context of the learning time factor, the full effect of which for a given learning experience is proportional to the ratio between required learning time and time of total task engagement--this last variable, for instance, being a function of the ratio between allowed learning time and student perseverance (Carroll, 1963). Under this conception, optimal quality instruction for a given student is closely related to his ability to understand instruction (Block, 1971) and both of these are overly determined by the student's own aptitude level, in turn susceptible to time factor variations. This is to say that, further to the establish-

ment of a student's entering level of readiness and the compensatory programme most appropriate for him/her (two other distinguishing features of the mastery approach), Bloom's mastery strategy definitely contains inbuilt provisions allowing for individual differences in the student's rate of learning as well as in his/her capacity to absorb skills and knowledge. Such provisions emerge in the form of supplementary learning experiences or prescribed remedial learning sequences and enriched free time, all evolving from the main core of original, teacher paced instruction and applied to the extent that it may be necessary to contemplate individual aptitude levels as determined by the time each student in the group needs to learn a given task to criterion. In this sense, Bloom's mastery approach to learning and instruction endorses teacher-paced instruction in the conventional group setting but with intervening time lapses programmed at specific points in the course of instruction in order to provide students of lower aptitude and intellectual ability with the extra time, the exact materials and the personally relevant mode of learning which they may require for prescribed task mastery (Kim, 1970). In this manner lower aptitude students are brought to the level of readiness required for group instruction each time a new learning sequence is begun in the component chain leading to overall course mastery which for Bloom's approach is summatively defined at the 80% performance mark in order to avoid unrealistic expectations and avert student reaction to them (Bormuth, 1969; Sherman, 1967; Block, 1971).

The Motivational Factor

It is obvious that the success of the integrative approach to instruction being sought in the Azores is contingent upon adequate motivation for learning, the development of which among students of lower social status has been affected by class-related difficulties in rationalizing the greater part of school learning as being necessary for meeting life demands, especially in geographically restricted areas where job opportunities are often limited. It also becomes clear that relying on the issuance of tangible rewards upon successful learning has a rather limited time perspective attached to it and stresses primarily on the present. To this extent, choosing to deal with the education of lower social status students from the standpoint of group-based learning and instruction through Bloom's mastery approach may well prove to be the most appropriate way of promoting the cognitive drive of these students at least on an immediate term basis. The satisfaction to be derived by students of lower ability from readily perceived instances of success at the learning of tasks which they would otherwise have failed to consolidate into reasonably adequate foundations for sequential group learning should in itself be sufficient to provide such students with the cognitive drive required for learning. As Ausubel (1964) states, most often the best way of motivating the unmotivated child is to ignore his/her motivational status initially and to concentrate on ways of teaching him/her as effectively as possible. The degree of success derived from such experiences would suffice to arouse the individual student to pursue his/her learning tasks to the extent required. And, if we believe that every individual

is capable of learning to some sort of criterion level should he/she be ready, properly instructed and provided with adequate learning time, it follows that the partitioning of basic subject matter into comulatively sequenced units[66] of instruction governed by the aforementioned instructional variables will provide for perceived instances of success straight from the start. Hence, should attained initial success be in any way predictive of further effort towards overall success, the cognitive drive required for a given student to successfully complete his/her major learning tasks should most often be present.

The Relevance of Different Approaches to Mastery Learning

Even though Bloom's approach "Learning for Mastery" has been emphasized as being the most viable solution to the problem of integrating students of lower social status into the mainstream of secondary school instruction, many contemporary approaches to mastery learning have been based on Keller's "Personalized System of Instruction" (1968), hereafter referred to as PSI, and to a lesser extent, on Postlethwait's "Audiotutorial".

As Goldwater and Acker (1975) state, the current tendency to brand the PSI approach as "individualized" or "personalized" instruction may be a reflection of the importance presently placed upon the self-pacing of learning. But notwithstanding all the possible advantages of the self-paced approach for actualizing deficient functional capacities, its application at present in the Azores is not feasible, either financially or administratively. Manpower needs alone would render the approach impractical from the start. McMichael and Corey

(1969), for instance, required nineteen undergraduate proctors in order to run a PSI programme for 221 college students, this particular feature being basic to the Keller (1968) approach which generally relies on extra-teacher assistance as a means of providing knowledge of results.

Suggesting the Bloom teacher-paced "Learning for Mastery" approach for the Azores in no way implies that the units of material typically employed in mastery learning approaches can in fact be mastered by the sheer majority of present day Azorean secondary school students within the time limits uniformly applied by the teacher to all students. Mere reliance is being place on the flexibility of the approach in allowing for normal group-based instruction whenever learning tasks may be accessible to the varying levels of student aptitude within a specified time and in providing additional help and time in those instances where one or more students may need to engage in personalized learning in order to overcome specific difficulties. To this extent, as previously mentioned, students of lesser aptitude would be brought to the level of readiness required for group instruction each time a new learning sequence is begun.

However, the advantages of suggesting the Bloom approach to mastery learning and instruction for the Azores transcend the mere functional aspect. One of the approach's greatest advantages, as a strategy capable of ensuring a single, reputable standard of education able to provide for instances of success irrespective of prevailing aptitude level, lies in the fact that its units of instruction are not by rule taught on an individualized basis, a feature which enables the

less capable students to profit from the benefits of group-based interactive learning (Block, 1974). This mainstreaming effect is initially achieved through the manipulation of the slower achieving child's level of readiness which, under Bloom's conception, is raised to the required degree of entering competence by means of a compensatory programmed unit (Kim, 1970) that must be completed before the first regular instructional session is attempted and, subsequently, through unit-related prescribed remedial learning sequences undertaken primarily on a small group basis.

Also, for the socially handicapped student who requires both detailed, qualitative feedback on achievement and individually optimal prescriptions for the resolution of prevailing difficulties, the Bloom mastery approach seems most relevant. By means of formative instruments, it provides each student with a full description of his/her learning difficulties while simultaneoulsy prescribing an appropriate remedial learning sequence in which the instructional correctives will vary from student to student according to the nature of individual learning deficiencies and to each student's preferred mode of learning (Block, 1971, 1974). The actualization of these fully diagnosed learning deficiencies constitutes a necessary condition for step-by-step progression towards overall course mastery, the attainment of which is then determined quantitatively through a summative evaluation of student achievement.

The aforementioned features no doubt contrast with those emphasized by such alternative approaches to mastery learning[67] as the PSI, where (a) learning is thoroughly individualized, (b) student performance is

graded on a unit-by-unit basis, (c) feedback instruments devised to describe a mere sample of the skills which the student has attained or failed to attain, and (d) where instructional correctives tend to be similar to the original instruction in mode, with the exception of some occasional tutoring by the proctor (Block, 1974, Tierney, 1973). However, choosing the Bloom strategy over its mastery learning alternatives as a means of ensuring school experiences of quality irrespective of prevailing aptitude levels by no means implies the overall superiority of the former approach over the remaining mastery strategies for ensuring greater student outcomes. Existing approaches to mastery learning and instruction appear to be, at best, gross and molar applications of basic operant principles not well enough specified as regards the ongoing study performance of individual students to warrant fair comparisons of effectiveness. In this sense, the author's main reason for choosing to apply the Bloom strategy as a possible solution to current Azorean educational needs stems from the fact that the limitations of the present situation in the Azores (mass education with limited technological, human and financial resources) merit recourse to a teacher paced approach to learning and instruction capable of alowing for the accommodation of varying levels of student aptitude within the framework of group instruction as achieved in the conventional classroom setting.

Towards the Application of the Principles Behind Mastery Learning

Apart from tracing the socio-political nature of Azorean educational needs, we have weighed the merits of applying a criterion-referenced mastery learning approach to Azorean secondary school requirements for group-based quality instruction allowing for individual differences in both the rate of learning and the intellectual capacity of students of varying social class background. We have also established a theoretical rationale for using Bloom's orientation as a means of ensuring a single reputable standard of education capable of providing individualized success irrespective of prevailing classroom distribution in aptitude. Through adequate research design, the principles behind mastery learning shall, thus, be applied in a typical classroom setting, the relevant instructional variables being realized in the context of prevailing differences in the time needed by students to learn materials to set mastery criteria. Even though the mastery learning strategy described in the procedure section of the present study was conceived for a university level course in measurement and evalution, as per the reasons expounded in the introductory statement, both the unit-by-unit procedures and the research design in itself are applicable to all levels of learning and instruction. It should be noted that present Azorean educational needs at the secondary school level fall short of requiring the kind of research aimed at establishing the reputability of the mastery method for the teaching of basic subjects to disadvantaged learners. With the classroom fully integrated as to aptitude distribution, the average research setting at the secondary school level would

not differ in essence from that which characterizes the present study in that both situations require that quality instruction on content of acceptable curricular standard be provided to a group of students revealing marked differences in their capacity to absorb the relevant skills and knowledge. Furthermore, the very need for memorandum L/T/ES-52/79, requiring that adequate steps be taken to curb existing rates of insuccess at the secondary school level, effective immediately, advises the suggestion and the subsequent testing on prospective teachers of plausible pedagogical alternatives. In the urgency of the situation, lack of possible teacher commitment to the enaction of classroom procedures inconsistent with those which they may have experienced as students, if only for the lack of direct exposure and perceived benefit, clearly indicates the feasibility of first selling the mastery approach to (prospective) teachers based on the results of world wide research, and of their own experience, and then concentrating on the necessary research at the secondary level as a means of obtaining proper "certification" of this instructional strategy in the Azores.

Footnotes

[1]See Bloom, B.S. Affective consequences of school achievement. In J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

[2]The bookishness and encyclopedic nature of Portuguese higher learning, commonly associated with the expository lecture method, was severely criticized by some 19th Century Portuguese educators who attributed the social and economic ills of the country to the "baccalaureate vice" which, in the words of Alexandre Herculano, merely served to institutionalize at the government level "an academy of poets and scholars" little prepared to deal with the challenges of a new world order. See Valente, V.P. Uma educação burguesa. Lisboa: Livros Horizonte, 1974, p. 23.

[3]Even though no research revealing such a trend among teachers in the Azores is known to be presently available, the fact that Azoreans in general are little sensitive to innovative measures and less willing than other social groups to risk in medium term ventures was all but established from the population sample derived by American researcher Robert Like, interviewed by the author in 1978 at the University of the Azores.

[4]The term common trunk of education is being used to describe the unified system of instruction recently instituted at the secondary school level in Portugal and resulting from the fusion of two institutions: the academically oriented lyceum (an institution that traditionally served the upper middle classes and the aristocratic sector) and the vocationally oriented technical school which catered primarily to students of lower social condition. See Sottomayor Cardia, M. Educação e democracia. Lisboa: Secretaria de Estado da Comunicação Social, 1976, p. 20.

[5]An early attempt to provide common trunk mass education was made in 1968 when compulsory schooling was extended from four to six years and a new branch of learning, the preparatory phase for secondary level studies, instituted to cover for the two year extension in mandatory studies. This new branch of learning, entitled to its own staff and facilities, was derived from the amalgamation of the introductory grades of both the lyceums and the technical schools and produced a single curriculum of mandatory studies. It, nonetheless, functioned alongside a socially differentiated compensatory system of lesser curricular prestige hastily instituted to cover the most isolated areas. See Grácio, R. Educação e educadores. Lisboa: Livros Horizonte, 1973.

[6]Far from being an individualistic expression of radicalism, the following criticism of the traditional Portuguese educational system merely aims at establishing the historical basis for the socially

differentiated system of education which prevailed in Portugal and in the Azores until recent years and is thought to be at the root of the problems affecting current educational reform.

[7]. . . are located 2,110 miles east of New York and 760 miles west of Lisbon between latitude (North) 36.55'-39.43' and longitude (West) 25-31.30'. The archipelago consists of nine islands of vulcanic origin and the economy of its 291,028 inhabitants, who share a total land area of some 902 square miles, is predominantly agricultural with over fifty percent of the active labour force engaged in the primary sector and, consequently, living in rural areas. The population figure given is not based on the latest census.

[8]The national dictatorship or Franquismo, resulted from the social and political instability which spread towards the end of the 19th Century and became connected with republican attempts to overthrow the monarchy for the sake of a democratic way of life. The regime conceded that power should eventually be transferred from the king and the political ruling class to the citizens, but held that such transitional process be made gradually as the people became better prepared to participate in representative elections. In the meantime, a provisional dictatorship of "men of good will" was necessary to oversee the kind of economic growth that, in the regime's conception, was the condition *sine qua non* for the achievement of a broader base of representation.

[9]The general concept of public education held by educators at this time was that of mass education, except perhaps for Ramalho Ortigao whose views tended to coincide more with those of the Franquistas. In effect, the post-primary reforms proposed by the last Director-general of instruction under the Franquista dictatorship, Agostinho de Campos, closely resemble those of Ramalho Ortigao in as much as the introduction of the natural sciences into the school curriculum and the use of the inductive method of instruction are concerned. The social discrimination component of both projects is a further point in common even if such discrimination is not as easily discernible in Ortigao's case. See Valente, V.P. Uma educação burguesa. Lisboa: Livros Horizonte, 1974, pp. 167, 179, 190.

[10]Agostinho de Campos cited by Valente, V.P., op. cit., p. 176.

[11]People outside a given socio-economic and cultural sect committed to the transmittal of culture to individuals of lower social condition within the same society. This concept is further explained by Valente, V.P. op.cit., p. 174.

[12]These personal qualitites are attributed by Agostinho de Campos to the illiterate person as a means of making a case for the education of a select middle class whose inertia and costly indifference are said to be the sole cause of national decadence. The rational of Agostinho de Campos in this area is found in Valente, V.P. op.cit., pp. 170, 171.

Although the education of the middle class was achieved at the expense of elementary instruction, with priority given to secondary and university learning, the regime was never able to completely disregard public primary instruction, just as the classic liberals had been unable to totally disregard post-primary education. See V.P. Valente, op.cit.

[13]Agostinho de Campos cited in Valente, V.P., op.cit., p. 173.

[14]In effect, both internal and external pressures placed upon the official policies responsible for such a situation resulted in a more relaxed attitude towards mass education in the years preceding the 1974 Revolution.

[15]Opinion of the members of the Corporative Chamber cited by Mónica, F.M. Educação e sociedade no Portugal de salazar. Lisboa: Editorial Presenca, 1978, p. 111.

[16]Opinion expressed in the newspaper O Diário de Notícias of February 6, 1930 and of August 20, 1931, cited in M.F. Mónica, op.cit., p. 111.

[17]António Ferro, cited in Mónica, F.M., op.cit., p. 116.

[18]This actually constitutes a recommendation formulated in the 1938 report of the Corporative Chamber. See Mónica, F.M., op.cit., p. 116.

[19]School inspector Joaquim Tomás cited in Mónica, F.M., op.cit., p. 118.

[20]Mónica (1978) not only points out that arguments in favour of basic elementary instruction were influenced by the perceived need to "control" volatile and casual city workers (p. 117), but also provides her reader with an insight as to the reasons for the existence of such a class in the main urban centres of the country. She points out that, not being insensitive to urban modernization, Lisbon and Oporto managed to attract a certain number of people from the country-side creating a sort of population boom (Lisbon's population doubled in 40 years) which easily provided for forms of political manipulation and agitation (p. 73). The same author (p. 206), in relating the public image of the primary school teacher in the decade following the *coup de etat*, points out that, in 1931, 91 percent of the primary teachers taught in the rural areas. This fact, however, says little about the educational conditions prevailing in such areas, which, for reasons of isolation alone, ran high risks of neglect.

[21]Virginia de Castro Almeida cited in Mónica, F.M., op.cit., p. 119.

[22]Even though no definite conclusions can be drawn by the author from the limited research materials available to him, it appears as if the first mass literacy campaign, undertaken on a country-wide basis and aimed at the population as a whole, only took place in the 1950s. And it seems to have been the result of internal embarrassment as well

as external pressure, eventually imposed by international organizations of which Portugal is a member. The state of affairs which characterized the organization of basic level instruction during the 1930s and 1940s would give further credence to the expressed point of view. In effect, Melo and Benavente, the only authors reviewed who place such campaigns on a time perspective, give no notice of their existence prior to 1950, which, of course, does not mean that no effort had been made in the area of literacy prior to this date. What is likely is that any such effort, granted that it existed, was either made by individual groups or simply failed at the outset. For a brief idea of how the literacy campaigns of the 1950s worked, and the results they achieved, see Melo and Benavente. Educação popular em Portugal: 1974-1976. Lisboa: Livros Horizonte, 1978, p. 27.

[23]Because of conflicting sources, there is some confusion as to whether the term of compulsory schooling required by law from 1910 to 1926 was in fact five or six years. While referring to the broad primary school curriculum in effect during this time period (and recalling that it had even been criticized for its amplitude by some democratic educators), Mónica (1978, p. 282) for example, states that compulsory school attendance lasted for five years up to 1926, just as Melo and Benavente (1978, p. 26) emphasize that it lasted for six years. The author would, however, be inclined to take M.F. Mónica's assertion on this matter given the scientific reputability of her work.

[24]Those who taught at the postos de ensino were in effect semi-literate people who had been unable or unwilling to obtain any type of occupation of a non-manual nature. Patronage nearly always played an important role in obtaining a position. See Mónica, M.F. op.cit., p. 208.

[25]The number of unqualified teachers working at the postos de ensino doubled from nine percent in 1936 to eighteen percent in 1940. See Mónica, M.F. op.cit., p. 209.

[26]In placing the passing rates for the year 1940 at 54% for the first grade, 70% for the second grade, and 58% and 72% for the third and fourth grades respectively, Mónica (1978, p. 334) points out that the rates for the postos de ensino were even lower. If the average passing rate was 61% in the regular schools, it was a mere 54% in the postos.

[27]Law-decree #27279 of November 24, 1936, cited by Mónica, M.F. op.cit., p. 215.

[28]Among the first measures of the dictatorship of 1926 were provisions for closing all schools with a population of less than 45 students. See Melo and Benavente, op.cit., p. 26. Also, in 1931 the Minister of Public Instruction determined that all schools that had been inoperative for lack of facilities for over two years be officially shut down. Law-decree 20-181 of July 24, 1931, cited in Mónica, M.F., op.cit., p. 220.

[29]For the reader wondering what the attitude of the teachers towards such orientation may have been, it should be stated that they had little choice but to conform to social and political practice for socio-political conformity was the measure of competence and most teachers, being of low social background and ill qualified academically, simply needed to survive in a country where opportunities in the private sector were (and still remain) limited. In effect, the government could always replace qualified teachers with unqualifed ones. For a wider and contextual treatment of this issue see Monica, M.F. op. cit., pp. 178-188.

[30]The values which the dictatorial regime most wished to promote coincided with the traditional values of the church: obedience, resignation and charity.

[31]As Mónica (1978) points out, primary school teachers in their daily contacts with students were well aware of differences in the intellectual capacities of their pupils despite all assertions that educability should be, first and foremost, a measure of obedience and respectfulness rather than a measure of intellectual achievement (p. 329).

[32]Cunha Gonçalves cited in Monica, M.F. op.cit., p. 310.

[33]Even the most innovative of teachers had little choice but to stick to outmoded methods of instruction. Extremely high student/teacher ratios (as high as 1/70 or more in some instances in the 1930s) coupled with multi-grade classroom composition (itself the product of lack of teachers and adequate physical facilities), preempted any recourse to modern teaching methods. Working in overcrowded classrooms with children of many different ages and with their reputation hanging on the number of students successfully prepared for the fourth grade government examination, teachers most often relied on fastidious mechanical exercises and strict classroom discipline in order to keep students occupied at all times, thus allowing for extra time to be spent with the crucial examination candidates. See Monica, M.F. op.cit., p. 338.

[34]Elementary school education had two distinct phases, the first, and longer phase, designed to teach the student basic notions of reading, writing and arithmetic and to develop in each child patriotic sentiments of "love for country" and the second phase, a complementary cycle of studies, aimed at introducing the student to specific life-related skills and at furthering his/her patriotic education. Conceived to provide the student with a practical education, the second phase of primary studies would purport to give students practical notions of agriculture, commerce and industry in consistency with the main economic activities of their respective regions. Patriotic education, however, tended to degenerate into Republican propaganda and, as basic industrial trainers, the Republicans perhaps did not intend to provide the masses with education of the same quality as that provided before to the privileged classes. (In this sense, Republican education could be said to have served the interests of the Republican ruling class as well.)

[35]The theoretical foundations of the Republican educational project as formulated by João de Barros were based on Rousseau's naturalistic conceptions and, as such, also hinged on the ideas of Pestalozzi, Claparede and others. See Valente, V.P. op.cit., p. 207, 208.

[36]In effect, freeing the country from an educational system which, according to João de Barros, merely sought to prepare for "passive obedience . . . [and] . . . docility without reflection" (cited in Valente, 1974, p. 200), was not the sole preoccupation of the Republicans. An equally important objective consisted in freeing the Portuguese educational system from the influence of foreign systems of instruction. Denying the regional character of truth, the Franquistas, who had been impressed by Prussian and Japanese rejuvenative efforts, had adopted foreign curriculi and foreign methods of instruction with the justification that science belonged to no one country in particular and that, as such, "protectionism in scientific matters . . . [was] . . . characteristic of barbaric and backward nations" (A. de Campos cited in Valente, 1974, p. 181). The Republicans later made such external reliance a point of contention, claiming that the practice of clinging to foreign educational models was susceptible of placing the country under the moral and intellectual dependence of others, leaving the nation independent in name only (that is, before international law). See Valente, V.P. op.cit., p. 201.

[37]The betterment of one's material status in the rural areas was assured mostly by marriage and inheritance.

[38]Mónica cites evidence to suggest that changes from subsistence type economies to market type economies stands to produce "radical changes in the state of awareness of individuals, their attitude towards primary instruction being one of the first to change." Based on the same evidence, Mónica further suggests that such changes are nearly always followed by an increased demand for elementary education. See Mónica, M.F. op.cit., p. 259.

[39]Just as João de Barros, the mastermind of Republican educational thought, contended that the ruling classes of constitutional monarchy had inherited propensities for mental servitude from a feudalistic and socially differentiated past (Valente, 1974), the average person not only accepted his humble condition as inevitable and unsurpassable but also regarded it as being inferior. Mónica (1978), referring to forms of invisible discrimination in the schools of the 1930s, points out that even among the children of the lower classes who attended public schools, the poorest would look upon those immediately above them in social status with respect and admiration (p. 338).

[40]. . . who later became Prime Minister when dictator Salazar suffered a stroke in 1968 . . .

[41]Marcello Caetano cited in Monica, M.F. op.cit., p. 137.

[42]Paraphrasing Caetano's thoughts as cited in Monica, M.F. op.cit., p. 137.

[43]Marcello Caetano cited in Monica, M.F. op.cit., p. 137.

[44]See: Diario de Notícias, November 21, 1934.

[45]The four year compulsory school system was reinstituted for males in 1956 and was extended to females on May 23, 1960. See Gracio, R. Educação e educadores. Lisboa: Livros Horizonte, 1973, p. 23.

[46]Notwithstanding the all too common teacher placement and replacement problem as well as the high turn-over rate in the profession and the shortage of fully trained and qualified teachers in many areas, it should be remembered that the increase in student population over the last three decades was met by percentual increases in the number of teachers which, in some instances, were greater than that of student increase. See Grácio, op.cit., p. 54. Also, unqualified primary school teachers comprised 16.2 percent of the population of elementary teachers in 1964/65, as compared to ten years before when the population of unqualified teachers stood at 30.9 percent of the elementary teacher population. Given the greater demand for elementary education in more recent years, such decrease would suggest a greater output of qualified teachers. Still, as Grácio (p. 56) suggests, the conclusions to be derived from the pondering of such indicators may be all but favourable.

[47]The officially prescribed textbook, of mandatory use, had been introduced into the system in the 1940s in an attempt to guarantee the proper selection of the models and values to be transmitted at the primary school level. The concept of the officially prescribed textbook may result in confusion of the reader of this thesis who, aware of endeavours to convey socially differentiated messages across the different social extracts, might be surprised with what perhaps seems to him as an ideologically equalizing factor. After all, as Mónica (1978) points out, Boudelot and Establet had presented in France "an ample set of circumstances in which bourgeois ideology was ministered through different processes [using different textbooks] to the students of the proletariat and the students of the bourgeois" (p. 286). However, in the context of the Portuguese official textbook concept, the seemingly unconciliatory question of how to educate students destined for different social roles from a common ideologic base will gain a clearer perspective when it becomes clear that, although the text was common to all students, the message it conveyed to those of different social extracts was different. As Mónica illustrates, in reading the story of the rich boy who gave the poor boy a toy for Christmas, children of different social extracts could identify with either one of two different values conveyed: charity and gratitude, each one being projected in accordance with the social condition of the reader who, being rich, would be incited to give and, being poor, would learn to accept with gratitude.

[48]Adopted from Grácio's (1973) account of the difficulties faced by Primary school "principals" in Portugal (p. 42).

[49]Writing about education in the more recent decades, Grácio (1973) reveals statistical results showing that for each 100 students enrolled in the final grade of the four year primary school system, only 70 passed the respective final examination, 18 entered secondary level studies, 5 finished secondary school and a mere 2 obtained a university degree. For an elaborate account of the socially differentiated nature of secondary level studies in Portugal, see Grácio, R., op.cit. and particularly, Cruzeiro, M., Antunes, M.L. Ensino Secundário: duas populações, duas escolas (I). Análise Social, 1978, 55, p. 443-502.

[50]Grácio (1973), citing F. Bowles, states that in 1950 only seven countries had single programmes of study covering the entirety of the students at a given level of secondary instruction. Nine years later, however, the number of countries having instituted such programmes had risen to thirty-seven.

[51]See footnote no. 5.

[52]The creation of a common trunk system of compulsory instruction for students wishing to go on to secondary school studies (irrespective of the branch of studies for which they may be destined: lyceum or technical school) did, nonetheless, provide for the interaction of students of varying socio-economic backgrounds, otherwise cut out for different paths of instruction. In crediting Veiga Simão with bringing together students of different social extracts under the above described circumstances, Grácio (1973) wonders whether such interactions will be welcomed by the dominant classes and whether enrolment in private schools might not increase as a result.

[53]An attempt was nonetheless made to convey an apparent equality of status between the lyceums and the technical schools by providing both institutions with the same structure of internal organization--a standard three year course of basic studies and a complementary cycle of studies lasting for two years (Cruzeiro & Antunes, 1978).

[54]The existence of such differences, although apparent to teachers, has not been scientifically determined in the Azores, but merely inferred from available research literature on social deprivation.

[55]The Partido Popular Democrático, now Partido Social Democratico, the largest of Portuguese political parties, not only calls for an equal opportunity mass instruction system of horizontal structure at both the elementary and secondary school levels, but also states, on its educational project, that the eradication of illiteracy in Portugal (still ranging from 3 to 78 percent in specific areas) must be achieved on a priority basis together with provisions for the civic and cultural promotion of the people. It is further contended that such measures of intervention be thoroughly organized and not left to volunteers at

specific times of the year, a recommendation which, apart from some unstated political concerns, may be indicative of the importance attributed by politicians to the social promotion of the masses (Caderno--PPD3).

[56]As Grácio (1973) points out, financial assistance in the schools may harbour rather obscure designs, namely generalizing education at a certain level or even recruiting the best of talents from among the general population to the benefit of the social class which detains power and control

[57]In 1979/80, 90.99 percent of all students who completed basic primary school in the Azores continued their education and, of two remaining possible options, three times as many students chose to enrol directly in the preparatory phase for secondary school studies. See Gil, J.F. Relação dos alunos que concluiram a segunda fase do ensino primario e prosseguiram estudos. Angra do Heroismo: SREC, 1980. Even though statistics of the total number of students who, having completed their sixth year of schooling, proceeded to secondary level studies were not available to the author, it is commonly held that their proportions is becoming ever more sizeable.

[58]Even though figures for the Azores were not immediately available to the author, in mainland Portugal, the percentage of children between five and six years of age attending kindergarten in 1960 was merely 1.1 percent, placing the country far behind other European countries in this respect. Low attendance may be explained by the fact that preschool education in Portugal was not free thus operating where parents were most convinced of its benefits and were best able to afford it. Lisbon, with nearly 10 percent of the Portuguese metropolitan population, was absorbing 50 percent of total enrolment in kindergarten. This was occurring at a time when other European countries were registering between 80 and 100 percent enrolment for children between five and six years of age. See Grácio, R. op.cit., p. 34, and also Cardia, S. op.cit., p. 18.

[59]Cited in Grácio, R. op.cit., p. 33.

[60]The government of which Sottomayor Cardia was minister actually sent Parliament a proposal for the creation of a system of preschool education at that time but after four years much remains to be done in this area of learning. Perhaps Grácio's (1973) suggestion that kindergartens be first created in the areas where they are mostly needed is not without its merit and should be carefully considered.

[61]. . . inferred from parallel situations described in the literature dealing with environmentally induced intellectual deficits as no studies exist in the Azores at present in the area in question. Great disparities in the distribution of aptitudes are, no less, confirmed by teachers as a rule.

[62]Even at the more advanced levels of study where the student digresses into one of several options, a number of common mandatory courses still remains in the curriculum.

[63]The above described system of secondary instruction has now been introduced in the Azores. For a better understanding of its structure consult the respective programmes of instruction for the complementary cycle of studies for the academic year 1980/1981.

[64]That prolonged environmental deprivation causes a deficit in intellectual development seems fairly well established. Should it be taken into account that cognitive development results more from variable and diversified environmental stimulation than from inherent genetic possibilities, it is realized that the restricted range and the less adequate and systematic ordering of stimulation sequences which characterizes the culturally deprived environment (Deutch, 1963) will necessarily have a decisive impact on the development of verbal intelligence and abstract reasoning capabilities. Prolonged exposure to such impoverished environmental conditions is more than likely to account for the development of poor perceptual discrimination skills and will invariably affect the child's language-symbol system as significant others can hardly be used as referents for correction and reality testing or as instruments for satisfying curiosity (Ausubel, 1964).

[65]Kersh (1971) and Pate and Crittenden (1971) have in fact employed mastery learning strategies to teach basic subjects to disadvantaged learners just as other researchers (Anderson, 1973; Block, 1972; King, 1970) have weighed the merits of mastery procedures for the teaching of advanced topics to average and above average students. See Block (1974, p. 16).

[66]. . . behaviourally defined in accordance with their respective objectives and learning outcomes and managed through the simultaneous manipulation of the instructional variables discussed . . .

[67]For a comprehensive comparison of Bloom's and Keller's approaches to mastery learning and instruction, see Block (1974, pp. 20-24) and Appendix A.

CHAPTER II

REVIEW OF THE LITERATURE

Foreword

In proposing Bloom's "Learning for Mastery" strategy as a possible answer to present Azorean secondary school needs for group-based instruction of optimal quality per learner, the author has assumed that: (a) the premises on which the overall concept of criterion-referenced mastery rests are empirically sound; (b) instances of perceived success will likely bring about further success through task perseverance notwithstanding inherent graduated difficulty; and (c) the aforementioned strategy can effectively provide for the accommodation of varying levels of student aptitude in the context of regular classroom instruction. An attempt to verify the above related assumptions will therefore be made in the present chapter by reporting the results of specific studies confirming, not only the predictive potential of selected mastery learning variables or the relationship between these and set achivement criteria, but also the effects of the approach to mastery learning discussed on student cognitive and affective outcomes. Given both the incidence of quasi-experimental studies associated with research on mastery learning (Peterson, 1972) and the existence of fairly extensive and selective reviews of the literature on the subject (Block, 1971, 1974; Peterson, 1972), the present review, rather than evolving from an independent search and evaluation of the relevant literature, shall respect the system of selection and research classification proposed by Block (1971, 1974).

Abstracting the most relevant literature on mastery learning as a means of enabling research specialists to draw the necessary implications from the reported findings, Block made it possible for the present author to be summarily exposed to some of the more expressive studies in the area of mastery instruction and design and to benefit from a previous screening process which either pointed out or eliminated anecdotal and less reliable results. Reliance on a published general survey of the literature would doubtless stand to provide both teachers and policy makers in the Azores with a more accurate assessment of the effectiveness of criterion-referenced mastery on students of varying aptitude and mental ability profiles, as the author was unable to gain direct access to many of the unpublished studies which originally validated the assumptions behind mastery learning. Such studies, reported mostly in the form of unpublished manuscripts, provide the most conclusive confirmation of the predictive potential of the variables which comprise the mastery model of instruction and, as such, should serve to complement the higher incidence studies dealing with the effects of full-fledged mastery strategies on student achievement.

Consistent with the above related reasoning, relevant published and unpublished studies unavailable to the author directly shall be reviewed from Block's annotated bibliography (1971). Its detail, as suggested earlier, readily allows the eventual researcher to derive the necessary implications and pose relevant questions from the findings as reported. Duly referenced descriptions and implications shall also be drawn from Block's 1974 research survey in connection with the literature being reviewed from sources in the present study.

A Description of the Mastery Model of Learning and Instruction

Mastery learning strategies of the type used for the measurement and evaluation course in this study express an attempt to alter the basic design of instruction and thus allow education to perform a function more coherent with present needs for generalized acquisition of the skills and knowledge which society requires for its enhancement (Bormuth, 1971). Under this alternative approach to basic instruction, the majority of students can be made to experience high levels of content mastery, should variability in student performance be permitted not in levels of achievement per se but rather in time required by students to attain a prescribed criterion of achievement (Washburne, 1922; Carroll, 1963; Bloom, 1971). As, under this conception, achievement replaces time as the constant factor in instruction--with the latter factor now being the variable unit in the curriculum (Washburne, 1922)--the degree of learning for a given experience becomes necessarily a function of the ratio of the time actually spent in learning to the time required to learn (Carroll, 1963; Block, 1971). The conceptual paradigm used by mastery strategists to relate the influence of such factors in student learning (Carroll's "Model of School Learning", 1963) rests, therefore, on the premise that basic aptitudes for learning are predictive of the rate at which rather than the level to which a given student might learn (Block, 1971), aptitude being, thus, identified with time rather than achievement as the variable unit in instruction (Figures 1 and 2 show the relationship between aptitude and performance when time and achievement are each expressed as the variable unit in instruction). Proposing that under

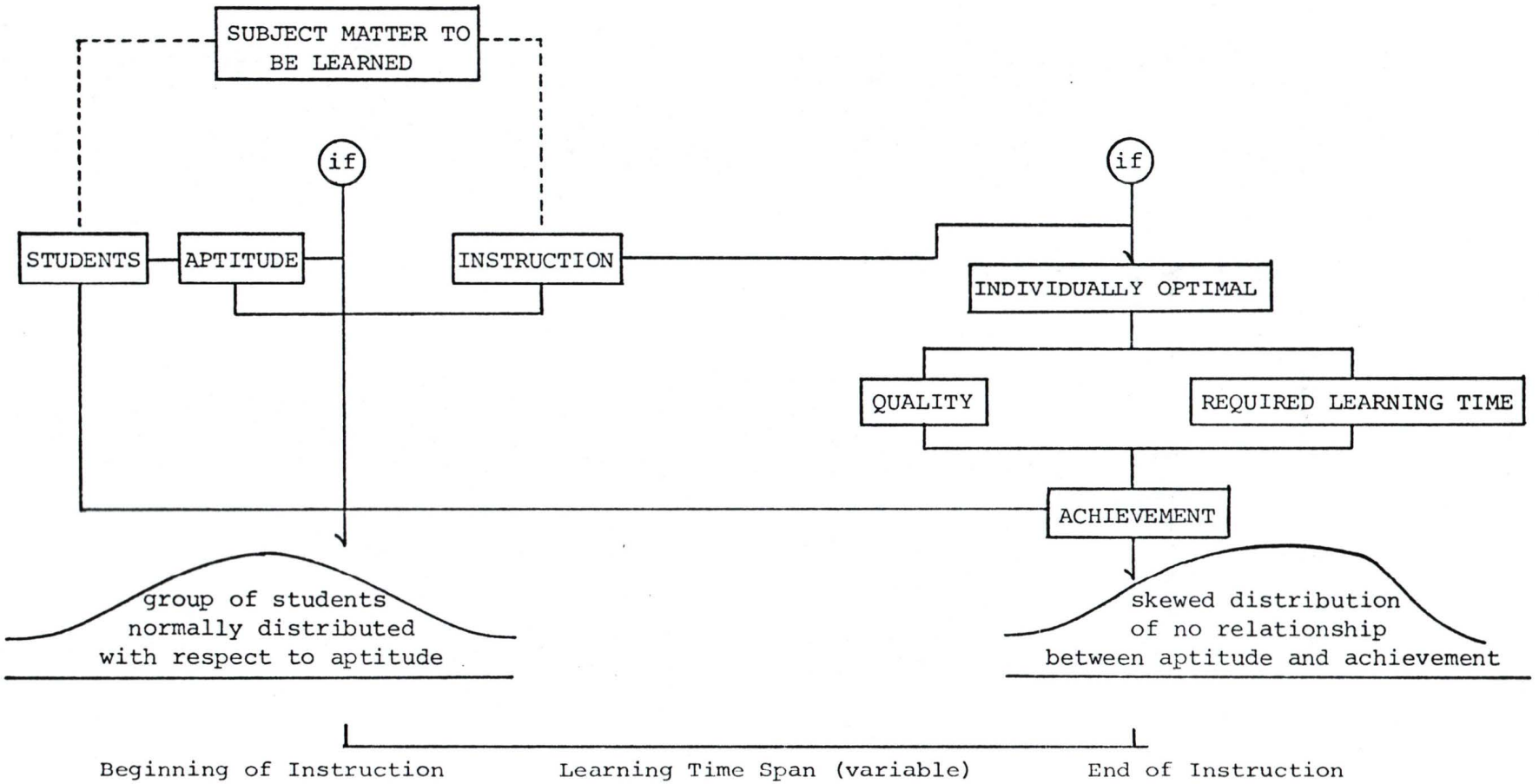


Figure 1. Relationship Between Aptitude and Achievement when Time Rather than Achievement is the Variable Unit in Instruction.

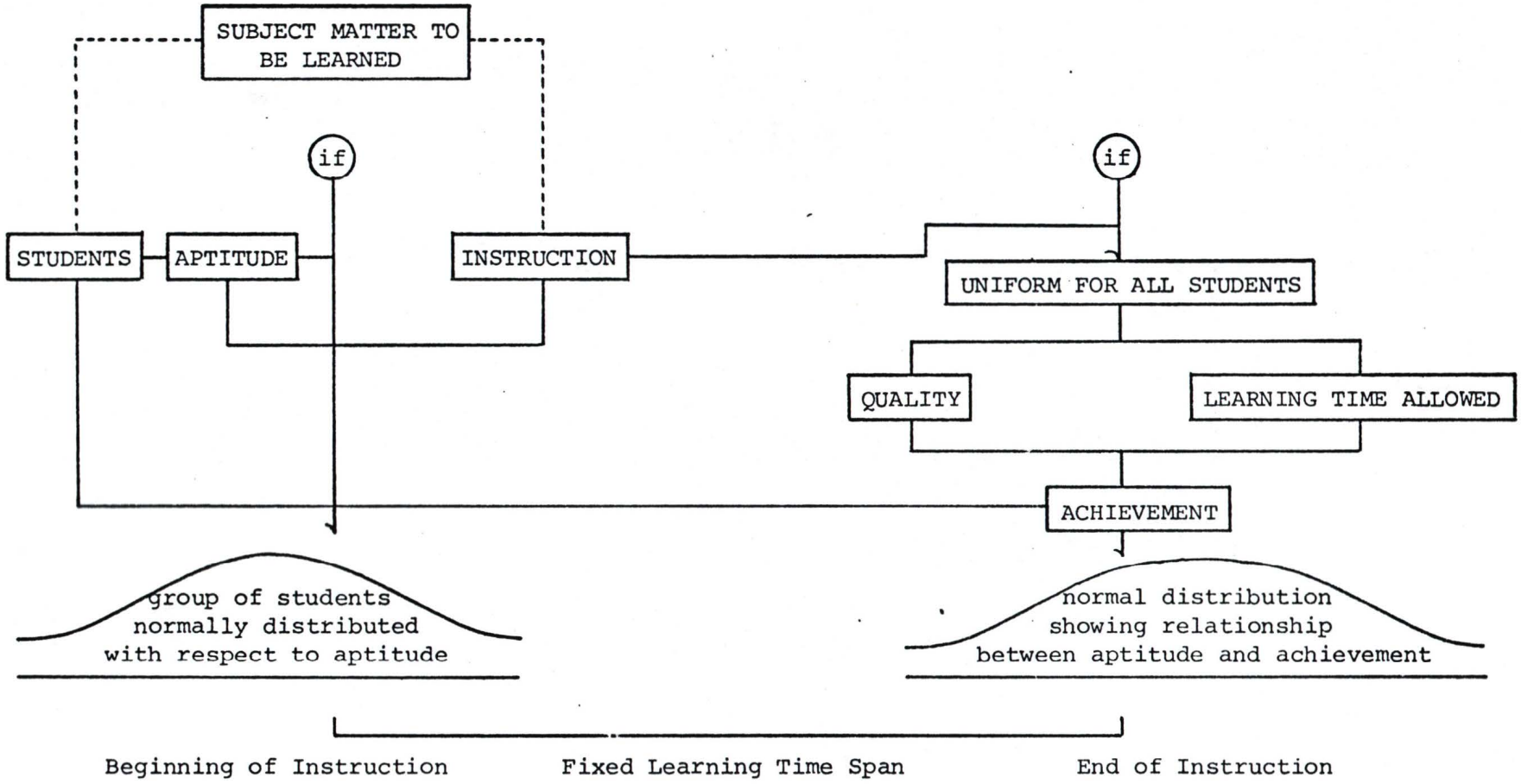


Figure 2. Relationship Between Aptitude and Achievement when Achievement Rather than Time is the Variable Unit in Instruction

normal classroom learning conditions both the time spent and the time needed to learn are functions of certain personal and instructional characteristics, Carroll's conceptual paradigm suggests that the former variable is determined by the student's perseverance (defined as the amount of time-on-task willingly spent) and by the total learning time allowed the pupil. The latter variable of required learning time is in turn determined by: (a) the pupil's aptitude, as defined above, (b) by the individually optimal quality of his instruction and (c) by his ability to understand the instruction provided. See Figure 3 for a visual perspective of how the variables comprising the "Model of School Learning" evolve in the context of instruction.

Common to all existing approaches to contingency management and criterion-referenced mastery is the basic notion that effective school learning consists of a series of distinct learning tasks (Carroll, 1963), hierarchical relations (Airasian, 1971) or ordered intellectual skills (Gagné, 1961) which permit each student's complex learning to evolve from a sequence of less-complex component behaviours (Skinner, 1954) that are to be mastered at each link of the component behaviour chain (Block, 1971). Such hierarchical arrangements of the learning materials are commonly held to provide greater learning efficiency and reduce variations in the time required by students to master given materials as the learning of prerequisite skills to the more complex behaviours is systematically assured at the proper times in the learning sequence (Bloom, 1974).

Apart from defining the elements comprising a given instructional unit and proceeding to analyze them into an organized hierarchy of

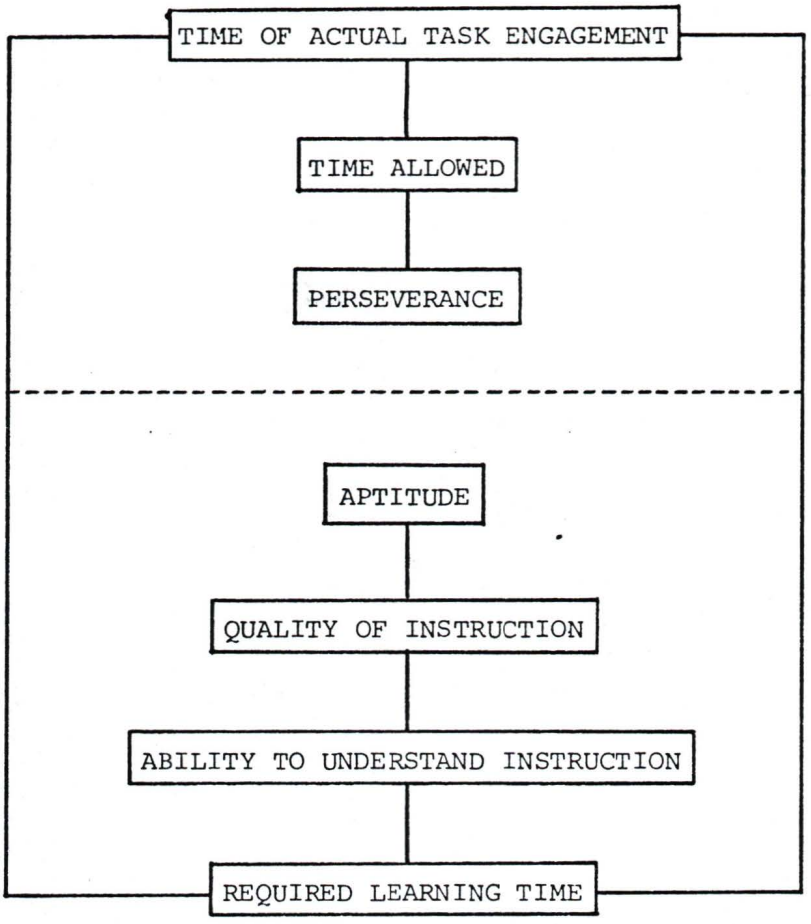


Figure 3. A Flowchart of the Model of School Learning as Proposed by John Carroll (1963)

component behaviours, the mastery model employs either individualized or group based instruction (Block, 1974) which is behaviourally defined in accordance with set instructional objectives. Initial main core instruction is built upon previously acquired knowledge of the student's entering level of readiness which is susceptible of being raised to the standard required for instruction through compensatory programmed units (Kim, 1970) instituted prior to the beginning of the regular instructional sessions. Provisions for feedback/correction procedures in the form of ungraded (formative) diagnostic tests and supplementary learning correctives are made at the end of each instructional sequence as a means of allowing for individual differences in the rate at which different students best learn and thus attain mastery as defined in terms of the relevant behavioural objectives (Block, 1971). Diagnosed failure in attaining the criterion of performance specified for a given unit of instruction prompts a prescriptive measure aimed at ensuring task mastery, a provision which makes achievement, not learning time the constant factor in instruction. Supplementary instructional correctives comprise both specific review of original materials, as is the case under the Keller approach (Block, 1974) and a variety of learning alternatives catering to the varying modes under which individual students best learn. Under Bloom's "Learning for Mastery" strategy learning correctives may rely on such diversified approaches to instruction as small group problem sessions, individual tutoring and alternative learning materials such as different textbooks, work-books and programmed instruction, audio-visual methods, academic games and puzzles or even reteaching (Airasian, 1971).[68] Figure 4 describes how the Bloom correctives evolve in the context of unit instruction.

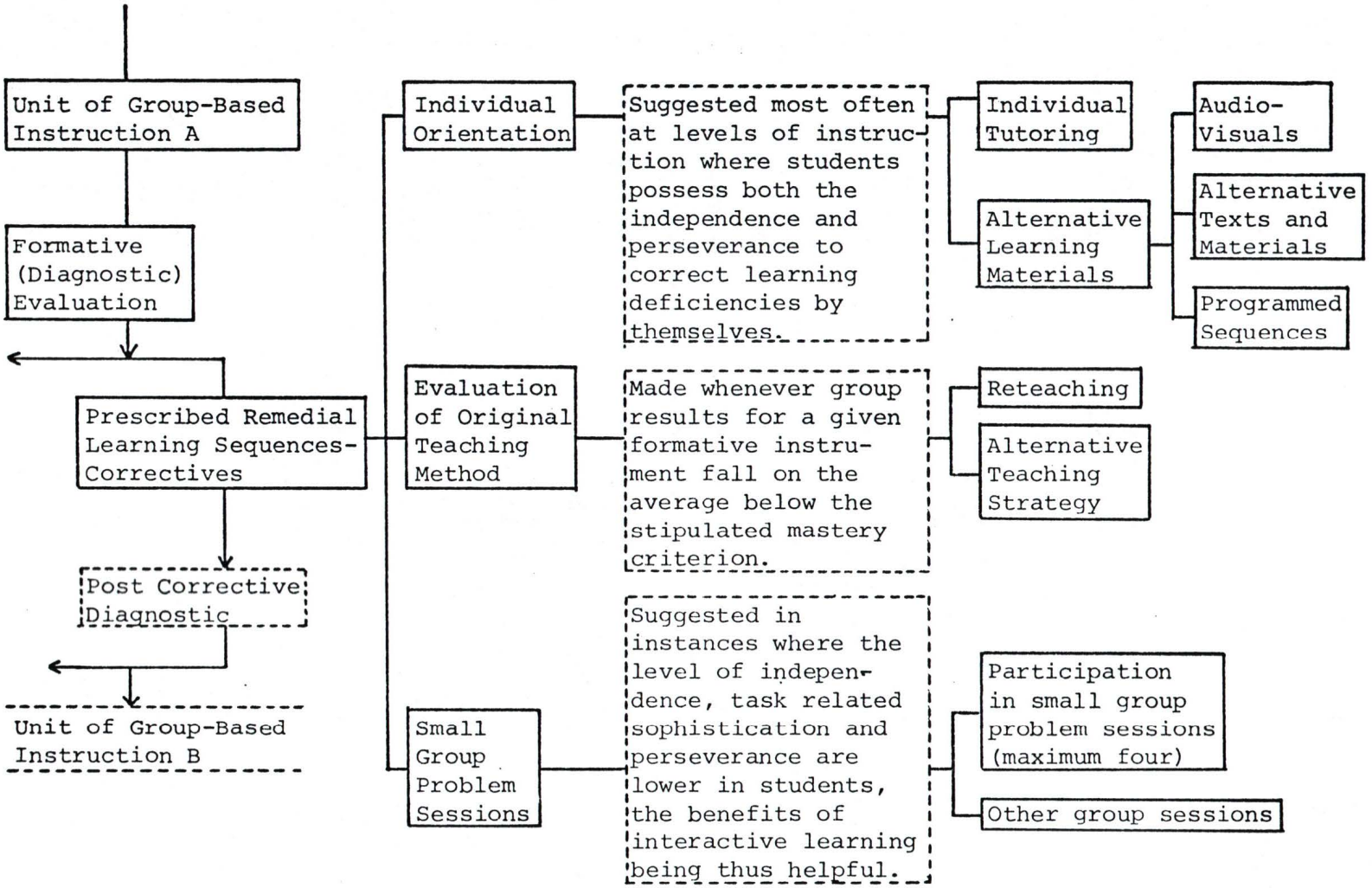


Figure 4. A Flowchart of the Positioning of the Bloom Type Feedback/Correction Procedures in the Context of Unit Instruction

Towards the Validations of Some of the Principles Behind Mastery Learning

Many of the conceptual propositions and model features described earlier have, in effect, been validated by empirical evidence. Sjogren (1967), who taught learning programmes to adults under three (optimal, near optimal and fixed) time conditions in an attempt to assess the variations in the time needed to complete learning, found a significant positive relationship between the ratio of time spent in learning to the time needed to learn and the criterion measure of aptitude and achievement adopted, thus confirming Carroll's (1963) assertion that the degree of learning is a function of the ratio of the time of actual task engagement to the time needed to learn.

Also, attempting to explore the influence of such variables as sex, intelligence and quality of instruction on learning rates, learning efficiency, perseverance and interest, Carroll and Spearitt (1967) found that, of the subjects attaining the set criterion of achievement, those originally assigned to the time flexible high quality of instruction condition required significantly less time to attain mastery than did subjects assigned to the low quality of instruction condition. Results on the measure of learning rate further revealed that time to criterion was significantly related to intelligence but not to sex and that poor quality instruction affected high as well as low intelligence students.

Still in the realm of time as a predictor variable in attaining mastery, a study by Wright (1967), investigating the relationship between the mastery of materials and time as defined by grade level

deserves attention. Defined as the subtest score corresponding to the .80th percentile on the first administration of the 1964 Stanford achievement test battery to the subjects concerned, mastery of the materials measured by each of the battery's subtests was eventually attained by most subjects but marked differences were found in the time needed by the grade school students comprising the sample studied to reach the predefined achievement criterion. Results showed that between subject differences in performance to criterion translated into time lags of one year or more with some subjects reaching at a given grade level the very criterion achieved by other subjects as much as one and one half years earlier.

Just as there were differences in the time required by a majority of students to perform to criterion across the different subject matter subtests in the study reviewed above, with the shortest time lag required for a majority of students to attain subject matter mastery being found, for example, in Arithmetic computation, Smith and Eaton (1939) report data which indicate equally marked variations in the rate at which subjects learned the different materials presented them in a situation aimed at studying the relationship of retention to speed of learning. Finding retention to be independent of original learning speed, results clearly revealed significant variations in the rate of learning of the different materials (words, names, dates, nonesense syllable, geometric figures, symbols and poetry), even though the prescribed learning task remained constant, implying in all cases the memorization of a mere sequence.

The implications to be drawn from the above described studies are two-fold: (a) that most students are capable of attaining high levels of mastery should they be allowed adequate learning time and (b) that students differ in the rate at which they reach a predefined criterion of performance.

Under a somewhat different line of research, Kim (1969), while studying the effectiveness of Bloom's strategies on student achievement in Korea, accounted for a rather interesting relationship between IQ and achievement. Results revealed that, of the subjects assigned to the experimental condition, fifty percent of those with below average IQ (< 93) achieved the set mastery criterion while only eight percent of the comparable subjects in the control condition achieved the same level of performance. Should it be considered that nearly as many mastery students with below average IQ as non-mastery students of above average IQ reached the stipulated achievement criterion (fifty percent versus sixty-four percent, respectively), legitimate doubts may be placed on the predictive role of IQ in school learning under mastery oriented instructional conditions.

Still in the realms of research on aptitudes and rate of learning, a study by Yeager and Kissel (1969) casts doubt upon the role of IQ as a predictor of learning time to criterion under programmes of instruction where the student proceeds at his own rate and is capable of attaining mastery in due time. Under such learning conditions, the authors found that the pupil's pretest score, his chronological age and the number of unit skills to be mastered, as measures of entering readiness, predicted the time he would require to master the relevant

unit materials in mathematics. IQ, as a fourth measure of initial readiness, had little predictive power with respect to the time required by the subjects in the sample to achieve unit mastery.

The above related results suggest the usefulness of breaking down learning experiences into hierarchies of manageable unit subskills and of raising deficient levels of entering readiness, as determined by pretest scores, to the level minimally required for instruction. Only then may feedback/correction procedures such as those used by Kim (1969, 1970, 1971) stand to offset the effects that IQ usually has on student achievement. This is because such a breakdown allows for the attainment of high levels of mastery within variable and individually optimal units of time. As results by Carroll (1963) and other researchers cited show, holding learning time constant, such that the period of actual task engagement is inferior to that which the student requires to learn, allows for individual differences in aptitude and mental traits to overly characterize student achievement.

The relationship between achievement and the use of feedback/correction procedures, as revealed in the studies by Kim, can be easily inferred from existing empirical evidence. Merrill, Barton and Wood (1970), who hypothesized much in the same way as Keller that specific review of material stood to facilitate learning at subsequent stages of instruction and yielded greater overall student achievement, reported that provisions for review at each stage, following detected task related difficulties, translated into more efficient learning for most students. In learning an imaginary science over five lessons, it was found that those subjects benefiting from specific review reached

the criterion of achievement in less total time than did their counterparts in the control condition, even though the former students had to cope with the original learning plus the added treatment features of diagnostic quizzes and review materials.

But perhaps of greater significance for the validation of the principles behind feedback/correction procedures is the evidence suggesting that instructional materials can be constructed to meet the strengths and the weaknesses of individual students. Studying the relevance of designing instruction in consistency with the mental ability profiles of students, Behr (1967) found several significant interactions between detected mental ability factors and mode of presentation (verbal-symbolic and figural-symbolic), clearly indicating that the degree to which one possess a given mental ability will predict the level of performance attained under a mode of presentation consistent with that very same ability.

Also, while predicting that performance in mathematics results from the interaction between the forms in which learning materials are presented and the intellectual abilities exhibited by students, Davis (1967) reported that greater achievement occurred whenever the content form of presentation (semantic or symbolic) stressed the subject's pattern of ability factors. Such results lead to the predictably safe conclusion that the quality of a given instructional experience may be enhanced, should inbuilt instructional correctives subscribe to diversified approaches to learning such that the varying modes under which individual students best learn are adequately respected. Still, going back to basic skills learning by returning

the student to the original instructional materials for assisted review and restudy constitues an alternative means of correction used in successful mastery learning strategies (Born et al., 1972; Barrera & Glasgow, 1976; and other PSI type studies).

As for the relevance of identifying the sequence of component tasks upon which the learning of more complex skills to mastery seems to rest, a study involving the identification of the hierarchical relations existing among the elements comprising given units of instruction in algebra and chemistry (Airasian, 1969) reported that generally more than seventy-five percent of the subjects' response patterns on the unit related formative (diagnostic) rests confirmed the hierarchical model hypothesized. In effect, subjects who failed to master the behaviour relative to the lower segments of the hierarchy for a given unit of instruction equally failed to negotiate the tasks inherent to the higher order behaviours evolving directly from the materials originally missed.

Gagné and Paradise (1961) also contributed to the validation of the concept of learning hierarchies in a study hypothesizing that learning rates are determined by specific kinds and amounts of intellectual skills. Probing at the interrelationships between intellectual skills, the abilities upon which such skills appeared to rest and performance on a learning task requiring the solving of some algebraic equations, the authors found that basic abilities were predictive of the rate of learning of the skills to which the ability traits were relevant. It was, however, found that the rate at which subjects learned the more complex skills overly depended upon the mastery of

the less complex component skills and not so much on the several basic abilities audited, these being more highly related to learning rate for the simpler skills.

The foregoing evidence suggests that, by ensuring mastery of the basic skills upon which the learning of more complex behaviours seems to rest, it is rather likely that the marked variations in required learning time which characterize conventional group-based learning will be considerably reduced and that learning will become efficient for most students, reducing thereby the time needed by a given individual to learn criterion over several units of instruction. In effect Bloom's (1974) contention that the amount of per unit engagement time decreases as the student's learning becomes more efficient is clearly reflected in the aforementioned study by Merrill, Barton and Wood, who reported that the total time spent by their experimental subjects on original unit learning (not including quizzes nor specific review) decreased considerably over a five lesson period. Thus, any amount of extra review, instituted at the beginning of instruction as a means of correcting detected learning inefficiencies, is bound to eventually compensate in terms of a subsequent saving in the time required by students to learn the relevant materials.

Some research done in the area of frustration and achievement motivation appears to corroborate the view that mastery learning strategies yield greater student perseverance as defined by time on task willingly spent. In a rather interesting study aimed at exploring the methods of studying frustration in children, Seashore and Bavelas (1942) reported that subjects tended to spend less time on each of the

subsequent trials of a given drawing, not because of increased efficiency in drawing due to practice effects, but as a reaction to frustration. The relevance of this study, as proposed by Block (1971), lies in the positive relationship it suggests between student perseverance and some form of needed reinforcement, such as, for instance, knowledge of results (as provided in the mastery learning strategies through the feedback/correction devices) or some other criteria of success made available as an indication of success or failure.

Also, while investigating the manner in which continual success or failure affected the persistance of students at the learning of basic tasks under conditions of success and failure, Weiner (1965) reported that students high in achievement motivation repeated more of the specified task-related trials in the failure condition than they did in the success condition. Subjects on the lowest quartile on achievement motivation, as measured by the T.A.T. and the Mandler-Sarason tests, on the other hand, persisted longer when performing under the success condition. Such findings suggest that at least for certain (poorly motivated, lower social class?) students perceived experiences of success, such as those derived from mastery learning strategies, are likely to ensure greater perseverance at specified tasks.

Still in the area of research aimed at establishing the effectiveness of success providing mastery learning strategies in promoting greater task perseverance, the aforementioned study by Carroll and Spearitt points out that subjects assigned to the mastery based individually optimal quality of instruction condition persevered more at

the required post experimental task than did their counterparts in the conventional, lower success condition. An exception was, however, reported for students of middle intelligence who, according to the author, probably applied themselves more to lower quality materials, while both the high and low IQ students quickly lost interest over such materials.

Further replications of the study by Carroll and Spearitt would be required in order to determine whether quality of presentation affects students of varying intelligence differently as regards task perseverance. It would also be advisable to determine the range of aptitudes, as defined by intelligence traits, existing presently in the Azorean secondary school system, in the event that the above findings are validated, for under such circumstances, the range of existing intelligence profiles will determine the overall effectiveness of the mastery approach with respect to post-task perseverance. Such a probe becomes all the more important in instances, such as that being prescribed for the Azores, where teaching is not individualized enough in terms of (a) starting point, (b) reinforcers used, (c) step sizes used and (d) branching available for ongoing remediation.

The Effects of Learning for Mastery on Students

Despite the aforementioned research dealing with the relationship between achievement and such mastery related variables as aptitudes and rate of learning, quality of instruction, time as a variable in attaining mastery and student perseverance, a great deal of research in mastery learning has been concerned with studying the effects of

full fledged mastery strategies on students (Block, 1974). Block (1971) reported that, by 1971 some forty researchers were studying the effect of mastery learning concepts and strategies on student outcomes. Within three years' time, studies in this area had become so voluminous that, in his published review of mastery research literature, Block (1974) had to classify studies dealing with mastery related student outcomes according to whether they sought to determine the impact of mastery learning concepts and strategies on student achievement, retention, transfer of training and interest in and attitude towards materials learned for mastery. Such was the interest for exploring the cognitive and affective outcomes of learning for mastery in formal school settings, that, at one point, some two hundred thousand students at over two hundred public schools in the United States were learning for mastery through one method or another (Harrisberger, cited in Block, 1974).

Most research concerned with the effects of learning for mastery on students' cognitive and affective outcomes has contrasted conventional lecture-discussion approaches with a Bloom type or a Keller-PSI type mastery strategy, using student achievement as the criterion for evaluating how student learning is probably changed as a result of exposure to either treatment. Whenever mastery and conventional approaches to learning and instruction are contrasted, available research indicates that (a) mastery strategies yield substantially greater student achievement in particular subject areas than do conventional methods and that (b) of the two most often used mastery strategies, Bloom's "Learning for Mastery" and Keller's PSI, the

former approach is particularly easier to assess in instances where mastery and conventional approaches to learning and instruction are contrasted, even if it fails to emphasize the unit perfection mastery requirement.

Adopting an interpretative scheme which uses final examination scores as the operational definition of mastery (Block, 1974), studies contrasting the Bloom method with the conventional lecture approach have relied on common criteria as a basis for making the relevant between-group comparisons regarding student achievement. In contrast with its mastery alternative, the Bloom approach does not determine final levels of achievement on the basis of individual performance on each unit of learning. Rather, its measure of overall achievement to criterion rests solely on the course's final examination which, together with the mid-term, figure as sole standards of achievement under conventional approaches to learning and instruction (Block, 1974). Notwithstanding those instances in the research literature where final examination scores figured, along with unit grades, as measures of achievement on a mixed, weight percentage basis (Calhun, 1976; Goldwater & Acker, 1975; Johnson, Zotlow, Berger & Croft, 1975), Block cites evidence suggesting that final examination performance tends to vary according to student perceptions of the weight that is placed upon this particular measure as a determinant of the final achievement grade (McMichael & Corey, 1969; Tierney, 1973).

As regards the unit perfection requirement, the model developed by Bormuth (1971) to identify rationally the best criterion levels of performance on set instructional materials failed to confirm the

perfection or near perfection (95 percent or more) requirement as being the level at which the desirable outcomes of instruction are maximized. There is also evidence to suggest that the unit perfection requirement, while consituting an unrealistic expectation in terms of student and teacher time and effort (Bormuth, 1969), may even have undesirable repercussions on student interest in and attitude towards learning (Block, 1970; Sherman, 1967).

Block (1970), while showing maximal cognitive results to be associated with the setting of high levels of criterion performance, reported that maintaining the criterion of performance at the 95 percent mastery level had over time repercussions on student interest in and attitude towards learning, even when learning to such a level produced the best cognitive results as measured by achievement, transfer and retention of materials. The same author also reported that the 85 percent criterion level of performance, while yielding somewhat lower cognitive results in the learning of three sequential units of eighth grade matrix algebra, did produce optimal effects on student interest and attitudes.

Clear cut results have no doubt been obtained with Bloom's procedure applied to student achievement. Reviewing the most relevant studies, Block (1974) reports that, in general, whenever the mastery criterion had been set at the 80 percent performance mark, roughly 50 to 75 percent of the students learning under the Bloom approach attained the same achievement level as the top 25 percent of the subjects learning under the conventional lecture methods. The same author makes equal reference to more extreme documented cases involving

university level students where as many as 95 percent of those learning for mastery under Bloom's group-based strategy attained performance levels equal to those of the top 20 percent of the students assigned to the nonmastery conditions.

According to Block (1974), the best examples of the impact of Bloom's learning for mastery strategy on student achievement are the studies of Kim et al. (1969, 1970, 1971) and Lee et al. (1971), involving Korean middle school children. Kim et al. (1970), who randomly assigned an urban sample of 5,800 seventh graders to a mastery or a nonmastery condition and sought to teach them English and mathematics over an eight week period, reported mastery results falling within the above mentioned 50 to 75 percent range of student achievement. Results for the nonmastery condition indicated that only 25 percent of the students learning through the conventional method were successful in meeting the 80 percent mastery criterion of performance in English and only 33 percent were able to do so in mathematics. Comparatively large differences in student performance were reported by the same authors (1971) when an expanded version of the same procedure was used on a mixed sample of 25,887 urban and rural Korean middle school children. Such large differentials in performance were corroborated by Lee et al. (1971) who reported between conditions differences in achievement to criterion as large as 20 to 30 percentage points for a sample of 12,000 fifth and sixth grade students, an outcome which, in view of the sample size, translated into an actual difference of thousands of students who were achieving to levels which they never imagined possible before (Block, 1974).

The aforementioned results are consistent with those of Kim's (1969) pilot study, involving Korean middle school children, as well as with those of Collins (1969, 1970), based on samples of secondary school and college students. Collins' second study, which, besides a control condition, comprised five experimental treatments, each containing an added feature of the Bloom strategy over the previous treatment, not only confirmed the results of the previous studies but also clearly indicated the cumulative effect on student achievement of the addition of the various Bloom mastery learning variables to regular instruction. Results show that the mere addition of behavioural objectives to the instruction increased the percentage of students attaining the mastery criterion from 40 to 60 percent while the addition of diagnostic problems to the core of the objective based instruction increased the percentage of the students attaining mastery over that of the previous condition by a full 10 percent. The addition of individually optimal prescriptions augmented this latest percentage figure from 70 to 80 percent. As such, the combined use of objectives, diagnostic problems and individually optimal review sequences systematically increased the percentage of those students attaining the mastery criterion from 40 percent, under the nonmastery condition, to 80 percent, under the Bloom mastery conditions (Block, 1971).

The magnitude of the systematic increase in student achievement produced by the Bloom mastery strategy is generally well accepted from the empirical standpoint, given the existence of "a common yardstick" (final exam scores) against which the performance of those students assigned to the mastery condition can be compared and contrasted

against that of students assigned to a conventional lecture condition (Block, 1974). Should final examination scores be accepted over unit grades as the standardized criterion of achievement across the mastery and nonmastery conditions, there is evidence to suggest that Bloom's strategy consistently yields greater achievement results when compared to conventional approaches to instruction. But, whenever the same standardized criterion measure of achievement has been applied across conditions (mastery/nonmastery) in studies whose interpretative scheme equates mainly unit grades with the course's criterion for achievement, no clear cut results have been derived. In fact, in his second review of the literature on mastery learning, Block (1974) reports that, of the aforementioned studies using the final examination soores as an achievement criterion, only those of Malott (1971), McMichael and Corey (1969), Moore, Mahan and Ritts (1969), Moore, Hauck and Gagne (1973) and Sheppard and MacDermot (1970) found consistent positive differences in achievement between those students learning for mastery and those learning the same materials through a conventional lecture approach.

However much the mastery approaches under review may produce different student outcomes as a result of prevailing differences in their overall concepts of mastery, strategy-inherent susceptibility to the influence of procrastination in learning may be a factor of greater importance in justifying the use of the Bloom strategy in the present study. As Block (1974) points out, there is evidence to suggest that the level to which students learn in a given period of time may have to do more with differences in the time at which they actually become engaged in

learning than with the rate at which they are capable of learning once the learning experience begins (Lloyd, 1971; Sheppard & MacDermot, 1970). The implications of such findings for self-paced learning are best reflected in the attempt of some of the researchers committed to individualized approaches to mastery instruction to eliminate the procrastination effects of self-pacing through the implementation of daily test programmes (Malott, 1971), instructor pacing procedures (Goldwater & Acker, 1975) or through other relevant means (Calhun, 1976; Sheppard & MacDermot, 1970). It should be noted that the enactment of such preventive measures by no means implies that self-paced learning is by nature susceptible of bringing about learning procrastination in excess of levels prevailing under other instructional situations, but rather that the effective implementation of individualized approaches to instruction requires the kind of hardware and technology-oriented instructional programmes which cannot be readily applied to existing classroom conditions. Still, by finding an expressive relationship between high initial procrastination and below criterion achievement for an individualized course in the experimental analysis of behaviour, Lloyd (1971) was indirectly suggesting recourse to such approaches to instruction as the Bloom "Learning for Mastery" strategy, at least in instances where proper instructional hardware and researched programming are unavailable for immediate application. Besides requiring less sophisticated hardware, the Bloom strategy is essentially teacher paced and, as such, requires that all students engage in learning at roughly the same time.

Evidence regarding the author's contention on the appropriateness of the Bloom instructional correctives for ensuring the remediation of ongoing learning deficiencies by catering to the varying modes under which individual students of widely different social backgrounds best learn is also available from recent research in mastery learning. Tierney (1973), whose college level study comparatively surveyed the effects of Bloom's and Keller's feedback/correction procedures on student learning, reported that, while no significant effect could be attributed to type of feedback/correction procedure with respect to recall (knowledge), subjects benefiting from the Bloom correctives revealed a significantly greater ability to apply the relevant materials. In the words of the author, the significant effect observed on the application section of the achievement criterion due to type of feedback/correction suggests that the use of such alternatives as small, cooperative group problem sessions proves superior to the simple redirection of students into the original learning media, insofar as the ability to apply the skills learned is concerned. As regards the affective criterion, the hypothesis of no difference in student attitude due to the type of feedback/correction employed was substantiated, although there was a trend for the impact of small group problem sessions on student attitudes to be greater than that produced by the redirected revision of materials.

However, of greater importance in Tierney's study is the finding that the use of feedback/correction procedures of either type had, in themselves, no impact upon student achievement and affect. Such results seem to contradict the research reviewed, insofar as findings

may suggest that the use of feedback/correction procedures have a significant impact on the quality of a given instructional experience. But, as Tierney points out, some of these studies either failed to control for the effects of pretesting (Collins) or for the impact which the mere distribution of course objectives can have on students (Kim et al.), suggesting, as per the same author, that feedback/correction procedures of the type employed in mastery learning are only effective when used in a mastery learning context of pretesting and distribution of course objectives. Tierney had not, in effect, employed a mastery learning strategy in his study, being merely concerned with a comparative study of two different approaches to learning correctives (course objectives, for instance, were not made available). There were other possible explanations for the failure of the study to reject the hypothesis of no difference in achievement between the feedback/corrective conditions and the conventional lecture approach (i.e., failure to ascertain mastery after each corrective and delayed feedback). But it would appear, as the author concludes, that mastery learning strategies are to be applied to instruction in their full context.

Studying the combination of elements in the personalized system of instruction, Calhun (1976) strengthened Tierney's earlier conclusion by reporting that the systematic experimental manipulation of the four components of PSI (small units of material, student self-pacing, immediate feedback and proctor/student interaction) and the required weekly lectures produced results suggesting the undesirability of dropping any feature.

In consistency with the rationale developed in the preceeding chapter and with the trend established in the review of the literature, the present study seeks to survey the effects of a Bloom type mastery strategy on the test performance and affect of university level students in a country other than Canada or the United States. The basic aim is to determine whether mastery related features such as (a) pretesting students and bring them to the required level of entering readiness, in accordance with set instructional objectives, (b) organizing instruction on the basis of task hierarchization and units of learning, (c) instituting feedback/corrective devices at specific points in the course of instruction, (d) tailoring remedial instruction to fit individual learning deficiencies and each student's preferred mode of learning and (e) allowing for individual differences in the rate of learning, as achieved in a teacher-paced group oriented setting, can combine to outdo both conventional instruction and a quasi mastery approach emphasizing structured learning hierarchies and unit testing (with and without feedback and no correctives) in providing for generalized experiences of success (cognitive and affective) irrespective of prevailing aptitude levels.

The present study purports specifically to determine (a) whether the Bloom mastery approach used with first year university students can compensate for their initial disadvantage in relation to students with greater course related experience and test sophistication learning under the conventional method of lecture discussion and (b) whether the Bloom method is superior to the above described quasi-mastery procedure when knowledge of results on unit tests is both provided and

withheld. Conversely, there is also the question of whether learning under the quasi-mastery approach without provisions for knowledge of unit test results is essentially superior to learning under the conventional method of lecture discussion; and, in this case, whether differences in previous course related experience and test sophistication will not be reflected in the levels of achievement resulting from the application of these two basic treatments, should they each be assigned a sample of subjects drawn from different populations. By the same token, it is relevant to consider whether learning under the quasi-mastery approach with provisions for knowledge of results on unit tests will produce the same effects on achievement as the full mastery strategy, in relation to conventional learning, and whether the effects of previous experience and test sophistication will reflect themselves in the same way between conventional learning and this latter quasi mastery variant as between the feedback deprived variant and conventional instruction.

An affective criterion devised to weigh the subjects' attitude towards the materials learned under the mastery and quasi mastery treatments will also be used in support of the data gathered on the achievement criterion. A full statement of the null hypotheses considered in the present study is made below.

Statement of Hypotheses

Hypothesis One

There is no difference in student achievement whenever least experienced and test sophisticated students learn for mastery under the Bloom "Learning for Mastery" approach and students with greater overall experience and sophistication learn the same materials under a conventional lecture discussion approach.

Hypothesis Two

There is no difference in student achievement between learning for mastery under the Bloom "Learning for Mastery" approach and learning the same materials by means of structured learning hierarchies with unit tests and no feedback or corrective components attached to the unit tests.

Hypothesis Three

There is no difference in student achievement between learning for mastery under the Bloom "Learning for Mastery" approach and learning the same materials by means of structured learning hierarchies with unit tests and knowledge of unit test results but no correctives.

Hypothesis Four

There is no difference in student achievement between learning by means of structured hierarchies and unit tests, without the feedback and corrective components, and learning under the conventional method of lecture discussion.

Hypothesis Five

There is no difference in student achievement between learning by means of structured hierarchies and unit tests with provisions for feedback on the unit tests and learning the same materials under the conventional lecture discussion method.

Hypothesis Six

There is no difference in student attitude between learning for mastery under the Bloom "Learning for Mastery" approach and learning the same materials by means of sequential learning emphasizing structured hierarchies and unit testing.

Footnotes

[68]See Appendix A for a perspective of the differences between Bloom's and Keller's mastery strategies.

CHAPTER III

METHOD

Subjects

One hundred and forty-one students comprising two sections of the introductory course in measurement and evaluation offered by the Department of Education of the University of the Azores in the second semester of the academic year 1980/1981 were the subjects in this research. These students served in the experiment in fulfilment of course requirements and all of the subject areas for which secondary school teachers are normally prepared were well represented in the sample. It contained no student known to have been previously exposed to any type of mastery learning strategy.

Treatment Conditions

Subjects participating in the present study learned materials pertaining to the aforementioned course in measurement and evaluation under one of four treatment conditions: (a) mastery, (b) tests only with feedback, (c) tests only without feedback and (d) nonmastery.

Instructional Features Common to All Conditions

Apart from the fact that learning evolved basically from teacher-paced group instruction, the efficient use of teaching and learning time was emphasized across all four conditions through common complementary readings, conceptual models and flowcharts which, besides placing the relevant subject matter in its proper perspective, reduced

in-class lecture time and practically eliminated time consuming blackboard writing. Both the subject matter learned and the two summative evaluations administered as dependent achievement measures for the study were the same for all subjects, as were provisions for the proper clarification, at the outset of the experiment, of the instructional objectives and specific learning outcomes inherent to the course of studies. Also, regular instruction was paced in each condition such that the time allowed for learning approached the optimal level for students of average ability. Instruction progressed according to the pace of learning preferred on the average over the two previous academic years by comparable students scoring between 13 and 16, on a grading scale of 0-20, on parallel summative tests covering the subject matter of the course in measurement and evaluation. The average preferred progression rate for the comparable students was computed arithmetically from the coded responses of a sample of students falling in the above described range of achievement on two assessment forms devised for the aforementioned course in the years 1978/1979 and 1979/1980.

Instructional Features Common to the Mastery and Both Tests-Only Conditions

In the mastery and tests-only conditions, instruction was essentially approached through a hierarchy of sequenced learning units, each comprising two or more of the tasks inherent to the subject matter under study. This hierarchical arrangement of course content was achieved by analyzing the relevant chapters of the course recommended textbooks (Marshall & Hales, 1972; Landsheer, 1976) into a

number of sequenced elements ranging from simple terms and principles to complex relations requiring the display of higher order reasoning capabilities. Under the hierarchical order established, the proper handling of the higher order application behaviours built directly upon the mastery of their immediate prerequisites at the comprehension level, just as these, in turn, depended on the adequate handling of the lesser, knowledge related skills (see Appendix B). Each of the hierarchies identified constituted a unit of instruction or learning sequence and comprised a variable number of learning tasks which were behaviourally defined by means of instructional objectives and specific learning outcomes. These hierarchies were then translated into ungraded tests of unit-related performance administered at or towards the end of each learning sequence.

Instructional Features Common to the Mastery and Nonmastery Conditions

Prior to the clarification of the instructional objectives and before the regular instructional sessions actually began, students assigned to these two conditions were administered a pretest highlighting course relevant tasks and broadly covering its prerequisite behaviours. This pretest purported to detect the level of sophistication of the students relative to the subject matter of the course rather than being designed to measure the effects of pretesting on student achievement. Its items merely provided for broad measures of readiness without giving a preview of the specifics of the subject matter or of the ways of testing them.

Instructional Features Unique to the Mastery Condition

Deficient levels of readiness pertaining to course prerequisites in general and to materials relevant to the first unit of instruction in particular, as detected by the pretest, were brought to the 80 percent level of entering competence (described as mastery in the present study) through a compensatory programmed unit which had to be successfully completed before the regular instructional sessions could begin. Those students whose initial levels of readiness met the standard of entering competence either opted for a period of free time while awaiting the beginning of group instruction or engaged in some course related activity outside of the learning materials reserved for group instruction.

Once the relevant instructional objectives were presented, group-based instruction progressed from unit to unit of learning in the sequence of component steps aimed at establishing overall mastery for the course as defined at the 80 percent performance mark on the dependent achievement measure.

Unit instruction of optimal quality per learner was achieved by using the unit related ungraded tests previously mentioned as feedback/correction devices aimed at (a) describing the instances in which subject performance over a given unit of instruction failed to reach the 80 percent mastery criterion and at (b) suggesting the alternative learning sequences required to bring the deficient performance to criterion. The latter instructional correctives, expressed in the form of prescribed remedial learning sequences, were designed to resolve detected learning deficiencies in a manner most consistent

with individually optimal modes of learning. However, recourse to instructor-assisted small group problem sessions was encouraged as much as possible over individual tutoring or programmed instruction as the basic mode of correction.

Failure to achieve to criterion on any of the ungraded diagnostic unit tests, hereafter referred to as formative evaluations, indicated inability to master a given unit's materials within the time limits uniformly applied by the instructor to all subjects. As such, those subjects failing to initially master a unit's materials were required to engage in a prescribed remedial learning sequence until such time as they demonstrated mastery over the task(s) at hand by performing to the 80 percent criterion on a parallel form of the original formative evaluation. Regular group-based instruction was only resumed for the following unit whenever the behaviours pertaining to the preceding segment of instruction were mastered by 90 percent of the subjects assigned to this condition to the criterion stipulated degree of achievement.

Whenever a given subject was successful in mastering unit materials within the uniform time allowed by the instructor to all subjects in the course of group instruction, he/she would await the resumption of regular instruction for the following unit by opting for either of the two alternatives originally made available to the subjects meeting the prerequisite standard of entering competence for the course. These alternatives involved free time or engagement in a course-related activity which did not directly coincide with the learning materials pertaining to the units of instruction (see Appendix C).

Failure to achieve to the 80 percent criterion on the first summative evaluation implied subsequent mastery of the points missed, but the ultimate correction of such problem areas did not alter the grade originally received. Inability to reach the mastery criterion on the second summative evaluation merely certified below criterion performance for that specific measure and provided the appropriate grade as this evaluation was carried out at the very end of instruction with no correction requirements attached for the points missed. This instructional procedure is synthesized in flowchart form in Appendix D.

Instructional Features Unique to the Tests-Only-with-Feedback Condition

Subjects assigned to the tests-only-with-feedback condition were provided with knowledge of results on indidivdual performance over the ungraded unit tests, which were formative insofar as the feedback component was concerned. There being no correction component built into the instruction under this condition, no formal remedial learning requirements existed as a means of ensuring the mastery of unit materials to the specified criterion level. However, once the student was provided with knowledge of results regarding his/her test performance over the materials pertaining to a given unit of instruction, he/she was not only in a position to undertake the remediation of learning deficiencies on his/her own, based on the diagnosis derived from the test results, but could also seek the assistance of the instructor to this end whenever he/she so desired.

Instructional Features Unique to Tests-Only-without-Feedback Condition

Subjects learning under the tests-only-without-feedback condition received no knowledge of results on individual performance over the ungraded unit tests, which, thus, lacked a feedback/correction component. The possible effect that the lack of provisions for knowledge of test results was bound to have on subject willingness to complete the unit tests over time was checked in this condition by means of an initial statement by the instructor to the effect that such tests were necessary in order for him to manage the instruction in accordance with detected strengths and weaknesses as revealed regularly by measured group performance.

The instructional features inherent to the tests-only-without-feedback condition differed from those emphasized in the nonmastery condition in two notable respects. First, the pretest featured in the latter condition was not provided in the former treatment. Secondly, the unit tests and learning hierarchies inherent to the tests and mastery conditions were not applied to conventional, nonmastery learning. Still, in view of the prediction that lack of provisions for feedback/correction would reduce the effects of both unit testing and hierarchization on achievement, the present tests-only condition was to be regarded, along with the nonmastery condition, as a control condition, should the mean performance of the subjects assigned to it be either equal to or inferior to that of the nonmastery subjects on the first dependent measure.

Instructional Features Unique to the Nonmastery Condition

For the nonmastery condition, there being no provisions for the arrangement of the content areas of the course into hierarchically sequenced units of learning requiring step-by-step mastery of materials, a logical ordering of the relevant materials was made consistent with the manner in which the subject matter under consideration was organized by chapter in the prescribed textbooks.

Even though knowledge of results on the pretest was provided for this condition, no compensatory programmed unit was used to remediate deficient levels of entering readiness and there was no requirement that those subjects failing to meet the standard of entering competence had to compensate for this deficiency in their own time. Still, whenever a given subject expressed a desire to bring his readiness to standard, arrangements were made whereby individualized help was dispensed by the instructor in the subject's own time for a period not surpassing the beginning of scheduled instruction. However, even in these cases of individual tutoring, no completion requirement was emphasized and, thus, the degree to which subjects managed to bring their entering levels of readiness to standard depended solely upon individual task perseverance and both the subject's and the instructor's time schedule.

For the nonmastery condition, instruction proceeded directly from the pretest phase with group experience of uniform quality per learner. Thus, absent from the core of instruction were: (a) formative evaluation devices indicating how the subjects were progressing over a given segment of instruction in terms of the designed instructional

objectives; and (b) remedial learning sequences capable of allowing for the correction of diagnosed learning deficiencies. No attempt was therefore made to provide each subject individually with the most personally relevant instructional cues, the required amount of active involvement in and practice of learning nor with the specific kinds and amounts of reinforcements his/her learning may have personally required. As in the tests-only-without-feedback condition, only traditional in-class group review, arising either from expressed individual needs or from instructor detected general weaknesses, was emphasized. Such review generally occurred prior to the summative evaluations of achievement.

The instructional features relevant to the different treatment conditions under which the subjects participating in the present study learned the subject matter pertinent to the introductory course in measurement and evaluation are placed on perspective in chart form in Figure 5.

Implementation

The subjects participating in the present study (n=141) were arbitrarily divided by the University's Registrar, for reasons of timetable placement, into two main groups of instruction (n=69 and 72, respectively) each officially comprising a single section of the course in measurement and evaluation. A four group random arrangement was then derived from this initial two group placement. Students in the first Registrar-assigned group (R.A.1/n=69) were subdivided

Conditions	Features					
	Measure of Entering Readiness	Behavioural Descriptions	Division of Course Content	Unit Tests	Learning Correctives	Main Core Instruction
Mastery	Pretest (with subsequent remediation component	Instructional Objectives and Learning Outcomes	By task hierarchization.	Formative: knowledge of results provided	Prescribed remedial learning sequences (multi-mode)	Group based Teacher paced -same learning pace -same subject matter -same summative achievement measures -same complementary readings -same teaching materials
Tests Only With Feedback					Possibility of student initiated instructor assisted remediation	
Tests Only Without Feedback				No knowledge of results provided		
Nonmastery	Pretest (without subsequent remediation component)		By Textbook Chapter			

Figure 5. Outline of the instructional features inherent to the treatment conditions under which subjects in the present study learned the subject matter prescribed.

randomly into two groups of forty and twenty-nine subjects each and those placed in the Registrar's second group (R.A.2/n=72) were randomly subdivided into groups of forty and thirty-two students each.

A registrar's record check revealed that the subjects included originally in group R.A.1 were all in their first year at the University while those originally placed in group R.A.2 were second, third and fourth year students with one or more related courses in Education to their credit and previous exposure to the type of test items included in both dependent achievement measures. From such an arbitrary arrangement it was, thus, possible to answer the question of whether learning for mastery under the Bloom approach could, by itself, compensate for the effects which previous course-related experience, test sophistication and number of years at the university were bound to have on student performance. Hence, the sample of forty subjects randomly derived from the upper class student R.A.2 group was assigned to learning under the nonmastery condition on a permanent basis, while the forty students comprising the larger of the samples randomly derived from the least experienced R.A.1 group learned for mastery, also for the duration of the course.

Of the subjects left over in the R.A. divisions after the mastery and nonmastery groups had been formed, those remaining in R.A.1 (n=29) were assigned to both of the tests-only conditions on a split period basis, while those yet unassigned from the original R.A.2 group (n=32) learned the relevant materials, on a permanent basis, through the conventional, nonmastery mode minus the pretest. In the split period tests-only arrangement, subjects received no feedback of test results

during the first phase of the experiment (tests-only without feedback) but were provided with immediate knowledge of results on their unit test performance over the second half of the course (tests-only with feedback). Inclusion of the tests-only conditions permitted a study of the effects which the specific mastery model features of learning hierarchy-related unit testing and provisions for immediate knowledge of test results may in themselves have on student achievement. On the other hand, learning under the conventional approach minus the pretest, far from being regarded as a treatment in its own right, was instituted as a mere means of determining whether the pretest given at the beginning of instruction to the subjects in the mastery and nonmastery conditions was, in fact, providing a broad measure of initial readiness, without affecting subsequent course related achievement per se.

As a means of curbing possible experimental bias while at the same time reducing to a minimum provisions for parallel group instruction over any single week, group-based (lecture) instruction was provided on the basis of the Registrar's initial two section arrangement. It was possible to allocate group instruction in this fashion since the assignment of the four randomly derived groups to the different learning conditions was worked out such that all subjects whose instruction proceeded on the common basis of task hierarchization and unit testing had all been initially placed in the R.A.1 group, while those students for whom instruction was organized by textbook chapter without provisions for unit testing had originally belonged to the R.A.2 group. As such, group instruction was provided twice a week on alternate days to each of the R.A. groups, while the remaining

session of weekly instruction was scheduled for both groups on the same day, with students originally placed in the R.A.2 group (n=72) receiving their instruction immediately before sessions for the first group (n=69) began. All classes were held at the new University amphitheatre and regular sessions lasted for fifty minutes. Except for the day in which classes were held one after the other for both groups, all instruction was provided at the same time of day.

Even though, as stated before, the subject matter learned in the course of the experiment was the same across all conditions, instruction on the basis of learning hierarchies involved a different arrangement of subject matter content than that emphasized in textbook chapter-based instruction, notwithstanding coincident materials or modes of presentation. As such, the instructional timetable set up for the course (see Appendix E) was rigidly followed in order to ensure that instruction progressed at the same weekly rate for each of the two lecture groups.

The teaching of the subject matter inherent to the course in measurement and evaluation was spread out over two broad periods of instruction, with a summative evaluation of achievement carried out at the completion of each period. This procedure permitted the assignment of a single group of subjects to both tests-only conditions on a split period basis, while providing for a second measure of whatever treatment effects were detected on achievement over the first summative evaluation for the permanently assigned groups. Results derived from the second summative (dependent) measure could well be compared with performance on the first dependent measure and be regarded as further

confirmation of the achievement level attained at the half-way mark by those students exposed to a single treatment for the duration of the experiment, since the learning experiences contained in the two main blocks of instruction were fairly well self-contained. As may be inferred from the course outline (see Appendix F), the hierarchical relations derived from the subject matter employed in the present study were mainly established within the bounds of the learning pertaining to each of the two periods or phases of instruction. In this sense, it is reasonable to predict that results obtained during the second phase of instruction would not be highly determined by the comulative effect of first period learning to the point where the proposed comparison of test results could become risky. However, even if non content skills and/or mastery of specific hierarchies inherent to the first period of instruction were to make second phase learning dependent upon the comulative effects of earlier learning, the final summative measure, considered by itself, could still account for any existing between group differences in performance, should the effects of previous test practice be properly accounted for.

For the groups whose instruction proceeded on the basis of learning hierarchies (the mastery and both tests-only conditions), each of the two periods or phases of instruction was subdivided into three units of instruction, for a total of six course-related units of instruction. For subjects learning under the nonmastery method, the two basic phases of instruction were subdivided into four general chapters, the first two of which were covered prior to the first summative evaluation, while the remaining two were completed under the second main block of instruction, between summative evaluations I and II.

Each of the two phases of instruction, together with its corresponding instructional units (mastery and tests-only conditions), were behaviourally defined by means of instructional objectives formulated in accordance with the Landsheere method (1976). Twelve general objectives and fifty-three learning outcomes were formulated for the course (see Appendix B). While the list of course objectives was presented to students in all conditions, learning outcomes in the mastery condition were specifically conveyed as operational statements of required achievement per unit of instruction. The behaviours inherent to the learning outcomes were classified according to the Bloom Taxonomy for the Cognitive Domain (1956), with the various categories of this classification system reflecting the relative importance of their corresponding levels of intellectual activity to the behavioural descriptions contained in the learning outcomes. Learning outcomes were formulated in such a way as to define precisely both the basic behaviour term and, whenever applicable, the conditions under which the behaviour was to occur and the criterion stipulated degree to which it had to occur. Also, the objectives commonly provided to students in the different conditions, while coinciding with unit related goals in the treatments emphasizing task hierarchization, were further defined for the mastery and tests-only conditions in order to stress concise step-by-step acquisitions over short segments of instruction (see note at the end of Appendix B).

The course of studies undertaken by the subjects who participated in the present study corresponded to one full semester of instruction at the University of the Azores and each of the two periods or phases of instruction upon which the relevant subject matter was divided was

completed in fifteen sessions of instruction, with all conditions meeting the same timetable. Specific time limits were established for the completion of each of the mastery units of instruction (formative tests and correctives inclusive) as a means of preventing the self-pacing of instruction and of avoiding the elapsed time effect which is often associated with learning for mastery. Managing learning time in this fashion required that all experimental features falling outside the realms of basic group instruction be instituted during an extra period of class time not surpassing the equivalent of one regular class session per week. As such, an extra time slot of fifty minutes was added to the period of regular weekly instruction each week that the lectures pertaining to a given unit of instruction were completed, thus providing for the enactment of the extra instructional features common to the lecture group whose instruction proceeded on the basis of learning hierarchies and unit testing (R.A.1). In spite of their occasional use, coinciding only with those weeks in which the units of instruction were first completed, these extra hours of class time were officially built by the Registrar into the regular weekly course timetable in consistency with current University policy allowing for as much as four session of weekly instruction per course.

During the aforementioned extra time slots, students assigned to the mastery and tests-only conditions were commonly provided with unit tests and immediate knowledge of results on a correct-your-own-test basis, but only during the second part of the experiment, when subjects assigned to the latter condition received qualitative feedback on unit test performance. During the first phase of the study, when subjects

assigned to the tests-only conditions learned without provision for feedback, students were required to pass their unit tests two places to the front for correction. Once corrected, the tests were submitted directly to the instructor who, upon recording the level of each student's performance, retained those instruments belonging to the tests-only subjects, while returning the remainder of the tests to the mastery students. Corrected unit tests were made available to students in the mastery condition by the instructor no sooner than one half hour after the end of the correction period. This was a precaution against possible contamination effects arising from the situation of having to dismiss subjects assigned to the tests-only conditions at the completion of the testing period so that those in the mastery condition could be provided with knowledge of results. The aforementioned procedure became all the more necessary in view of the fact that student perception of the need for unit tests differed between the mastery condition and the tests-only-without-feedback condition. Students in the latter condition, for instance, regarded unit testing as a mere teacher's guide to better instructional management and those assigned to the former condition considered it as a full fledged feedback/correction device with formative characteristics.

Students in the mastery condition failing to meet the 80 percent criterion requirement on the unit tests were required to sign up for correctives on a sheet prepared by the Department of Education for that specific purpose and affixed to the door of the instructor's office just before the corrected unit tests were made available to the students. With learning correctives taking place on the student's own time, the sign-up sheets listed a full range of possible times for the

correction of unit-inherent learning deficiencies covering not only the afternoon of the day in which the unit tests took place but also the entire next day of classes. Students signed up for correctives in groups of four to six and the time initially allowed for the remediation of detected problem areas varied between thirty and forty-five minutes, depending upon the amount of subject matter covered in each of the units of instruction over which specific correction procedures were enacted. Each group of four to six students signing up for correctives at any given time undertook the remediation of its unit-related learning deficiencies on a small group problem basis, where the solution to individual problems was viewed as a collective concern. Group composition was either planned by choice of those signing up or was derived on a one-by-one basis according to the times which best suited individual students.

Each small group problem session was instructor-assisted (hence the time restriction of thirty to forty-five minutes placed per session). Thus, having a readily available source of guidance and reference, student progression at the resolution of prevailing learning deficiencies was not hampered to the point of making the correction procedure inviable within the time limits set. At the end of each remedial session, the instructor verified the extent to which the students mastered the materials pertaining to the unit of instruction for which the correction procedure was instituted by means of test items parallel to those comprising the original unit test. Subjects still failing to meet the 80 percent mastery criterion upon the completion of the corrective measures instituted had to choose between (a) signing up

for a second small group corrective session in any time slot still unfilled with the required number of students and (b) approaching the instructor individually to arrange a session of individualized tutoring. These individualized tutoring sessions took place either at a mutually (for student and instructor) convenient time before the next scheduled session of group instruction or, whenever the number of students requiring such assistance so justified, in the time slot corresponding to the first period of regularly scheduled instruction following the enaction of the correctives.

Allowing for the occasional remediation of persistent learning deficiencies within the time originally allocated to group instruction was made possible, since, as previously mentioned, the extra sessions instituted for purposes of enacting the instructional features unique to the mastery and tests-only conditions were incorporated by the Registrar on a weekly basis, rather than just over those weeks coinciding with the completion of the units of instruction in which the extra sessions were held as testing periods. Each week of instruction was, thus, flexible by a full class session, which could be used sparingly between unit testing sessions, should the need to give the mastery subjects extra time for correctives require that weekly instruction be rearranged to accommodate both the correction time period and the three regular instructional sessions. Whenever weekly instruction had to be so altered, provisions were made whereby subjects assigned to the corrective deprived tests-only condition (but who received common group instruction with the mastery subjects) were informed of the change in the week's lecture arrangement.

During the second part of the experiment, prescribed learning correctives were instituted as above, but the system adopted for revealing knowledge of results on unit tests differed from that which was followed during the first phase of the study. Since, during the second part of the experiment, both the mastery and tests-only students (the latter group now matching the former in learning with provisions for feedback of test results) corrected their own unit tests, they automatically received knowledge of results upon the completion of each correction procedure. Students in both conditions were free to discuss and analyze obtained results among themselves or with the instructor but only for the duration of the testing period. At the completion of each of the unit testing periods, all tests were collected and retained by the instructor, being made subsequently available only to those mastery subjects requiring learning correctives but, again, only within the time limits set for each remedial session. The purpose of retaining the unit tests was to determine whether the availability of these tests for study was in itself susceptible of accounting for significant differences in student achievement over the corresponding summative measure.

Consistent with the extra time slot added to the period of regular weekly instruction, for purposes of testing, during those weeks in which the units of instruction were completed by the mastery and tests-only groups (R.A.1) students assigned to conventional learning (non-mastery, R.A.2 group) were also provided with an extra class period for review and discussion at the points in the course timetable coinciding with those demarking the end of unit instruction for the R.A.1 group.

Providing for periods of unit testing without interrupting regular instruction and scheduling learning correctives outside of the normal classtime was thought preferable to assigning the entire unit testing/correction procedure to regular timetable periods specifically set aside for ensuring the full application of the features falling outside of the realm of group instruction in both the mastery and tests-only conditions. In effect, any option relying on testing and correction procedures which intervene solely in regular classtime would require strict enforcement of the time limits originally made available for correctives, so as to prevent extended breaks in instruction and, thus, avert susceptibility to possible motivational and cognitive losses for the students not actively engaged in remedial learning (correctives). To this extent, any breaks operated in the course of regular instruction, as a means of allowing for the total in-class enactment of specific feedback/correction procedures, had to be necessarily planned such that the learning deficiencies of all those failing to achieve to criterion on the mastery unit formative tests could be fully corrected within the amount of in-class time provided, while the corresponding free time allowed to the remainder of the subjects did not serve to upset their normal progression at learning. Following this alternative route no doubt implied the meticulous planning of all course activities (by course, unit/chapter and lesson) in a manner susceptible of ensuring maximal learning opportunity within the bounds of an overly rigid timetable. Such an alternative also suggested the construction of an exhaustive measure of initial readiness (to be used as a prognosis upon which to base specific lesson planning) that the present study was unable to incorporate.

The regular instructional sessions held within each of the two lecture groups (R.A.1 and R.A.2) followed the instructional model proposed by MacDonald (1965). The mainstay of unit or chapter instruction comprised three distinct phases: a response-guidance phase (teacher dominated), a response-practice phase (student dominated) and a feedback phase. And six basic steps were added: (a) motivation, (b) presentation and (c) discussion of materials, (d) control (ascertaining the accuracy of the learning), (e) small group activities (for the consolidation of materials) and (f) application of the materials learned. Homework assignments, whenever issued, coincided mainly with the response practice phase and, much in the same way as the group activities and the application tasks, stressed intellectual activities at or beyond the second level of the Bloom (1956) classification system for the Cognitive Domain.

Motivation was concerned with the arousal of individual interest in learning. The basic motivational strategy used aimed at creating in each student a perception of his/her state of need or purpose for learning before the lectures pertaining to each chapter or unit of instruction were attempted. An actual example was pondering the affective consequences of implementing a classroom alternative to norm-referenced summative evaluation (see Appendix C).

The response-guidance phase comprised the instructional steps of motivation, lecture presentation of materials and teacher-monitored (control) single group discussion of the subject matter conveyed and emphasized thought processes up to the "comprehension-interpretation" level of the Bloom classification system. The response-practice phase,

on the other hand, included all small group and application activities and, as previously mentioned, emphasized thought processes at or beyond the second level of the Bloom taxonomy. Figure 6 describes in diagram form the model of instruction applied in the present study. The six instructional steps are laid out according to their corresponding response phases and classified as a function of the level(s) of the Cognitive Domain predominantly emphasized in each step. A diagnostic/ prescriptive step has been added to the feedback phase in order to allow for the feedback/correction component which characterizes mastery approaches to learning and instruction. Arrows indicate the instructional range of each step.

Achievement Measures

The subjects were graded with respect to their mastery of the overall course objectives by means of two summative evaluations of achievement (dependent measures), each covering a sample of the instructional materials contained in the units of instruction/chapters falling under its range of evaluation. Results were reported in the form of single summed scores which determined, for the materials pertaining to each measure, whether a given student had achieved or failed to achieve to the criterion stipulated performance mark of 80 percent set as the mastery level of achievement. All summed scores were reported on the numerical grading scale of 0-20 approved for Portuguese Universities.

The behaviours that each student was required to perform on each of the two summative measures corresponded to those emphasized in the

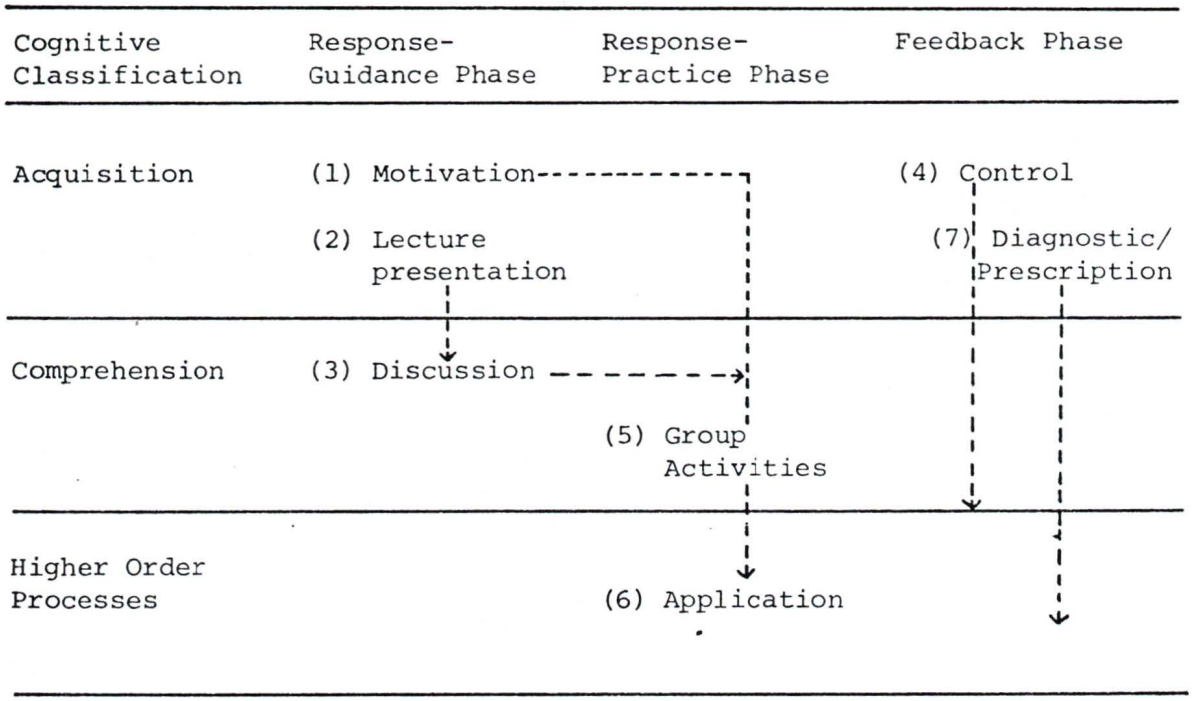


Figure 6. Model of instruction applied to the regular instructional session.

list of instructional objectives defined for the course. As such, standards of performance listed as specific learning outcomes were operationalized, for purposes of testing, according to the levels of the Bloom classification system previously mentioned. Within the knowledge (I) level, emphasis was placed primarily on the knowledge of specifics and on the knowledge of ways and means of dealing with those specifics, while performance at the comprehension (II) level implied mainly translation and interpretation of the specifics acquired, without necessarily relating them to other materials. Behaviours classified at the application (III) level, in turn, implied the ability to use skills previously learned in particular and concrete situations.

The summative instruments were constructed from two tables of specifications (one per measure), which served to coordinate the aforementioned levels of intellectual activity with the content areas relevant to each instrument. Each summative evaluation was planned on the basis of three content areas, defined in the table of specifications as areas "a", "b" and "c". The areas of content relating to the first summative test were made to coincide with the materials emphasized in the three units of instruction pertaining to the first instructional phase (first part of the experiment), while the content emphasized in the second summative measure corresponded to the materials relevant to the units of instruction covered during the second phase of instruction.

The table of specifications was constructed in the exact same fashion for each of the two summative measures. Relative weights were

computed for each of the content areas and the number of items attributed to each was recorded horizontally, adjacent to individual letter designations denoting the specific content areas. The different levels of intellectual activity (designated as I, II and III) were equally assigned weights and the test items corresponding to each level were recorded in column fashion under their respective roman numeral designation. Area content weights were calculated by finding the ratio of the number of class sessions spent per content area to the total number of sessions spent on all content areas combined. The relative values of the levels of intellectual activity were determined by multiplying the relative weight of each of the learning outcomes covered per instrument times the number of outcomes classified at each of the three levels of intellectual activity being measured. The number of test items to be constructed for any given cell of the relation content areas/intellectual activity was, in turn, calculated by multiplying the relative weight of the relevant content area times the relative value of the desired level of intellectual activity times 60 or 80, these latest figures being the total number of test questions in the item pools devised for the first and second summative instruments, respectively. Read horizontally from each of the letter designations, cell values indicated the number of items attributed to the respective content area across the different levels of intellectual activity. Column values per roman numeral, in turn, indicated the number of items attributed to the respective level of intellectual activity across all content areas taken together.

Through the tables of specifications constructed (see Appendix H), it was possible to determine proportionally to the total number of pool items for each summative evaluation the approximate number of test items that should be measuring the behaviours inherent to each cell denoting the relationship expressed in the table between a given content area and any one of the levels of intellectual activitity being considered. Conversely, it became possible to determine, say, for any given level of intellectual activity the number of items that approximately reflected the magnitude of its relationship with one or more of the relevant content areas. Also, by adding the test items calculated for each cell of the relation content/intellectual activity, by row or column, marginal values could be obtained to reflect, respectively, the overall number of items required per content area across the three levels of intellectual activity represented and the number of items needed per level of intellectual activity across the content areas taken as a whole.

The test items comprising the item pool devised for each of the achievement measures were drawn directly from the test booklets that had been constructed for parallel summative tests administered to students registered in the introductory course in measurement and evaluation over the two previous academic years. This was planned such that results obtained in each of the same measures in the course of two different academic years could be correlated and taken as a rough indication of the consistency of each measure. In the absence of an exhaustive measure of initial readiness constructed on the basis of items parallel to those latter figuring in the achievement instru-

ments, no other estimate of reliability could be derived for the summative measures used in the present study as an indication of the consistency with which the items comprising each of the summative tests were measuring the general traits of the students.

Each of the measures from whose item booklets the questions used in the present study's achievement instruments were drawn, when administered to students enrolled in the course over two successive academic years, yielded results which correlated positively with one another (r=.74 and .70, respectively, for the first and second summative tests). As the items figuring on each measure comprised a randomly chosen sample of fifty percent of the questions making up its respective test booklet, it was decided, in view of the significance of the correlation coefficients reported, to adopt the test booklets, as they were, as item pools and to follow the same randomized selection procedure in choosing the items for each of the present achievement instruments. Hence, summative evaluation I comprised thirty items randomly chosen from its item pool of sixty multiple-choice, true/false, completion and short answer recognition- and supply-type questions (distributed proportionally according to area content and intellectual classification weights), while summative evaluation II was made up of forty-three questions randomly derived from its own item pool (n=80), which, aside from the types of items already mentioned, contained eight matching items. Both tests were designed for completion within fifty minutes of class time.

Affective Instrument

The attitude questionnaire used in the present study was adapted from that used at the University of Victoria for course and teacher evaluation purposes. It contained seventeen items which purported to determine (a) student interest and attitude towards the specifics of the course as given, (b) student knowledge of the course's existence prior to actual engagement, (c) student perception of the role and effectiveness of the instructor as a facilitator of learning, (d) perceived relevance of the subject matter of the course for future professional application, and (e) perceived effectiveness of specific instructional features for ensuring better learning. The last questionnaire item was open to relevant comments and observations and one of the items was concerned with determining whether students enrolled in the course were decided on seeking to enter the teaching profession upon completion of their university training.

Due to unforeseen technical limitations, the attitude instrument was prepared for and administered only to students assigned to the mastery and tests-only conditions and no provisions were made possible for the enaction of a test/retest procedure as a means of determining the reliability of the adapted instrument. (See Appendix I for item details on the affective questionnaire.)

Unit Tests

Unit instruments were generated from the tables of specifications initially devised as blueprints for the appropriate selection of summative test items. The average number of items per unit test was fifteen and the time allowed for the completion of each test varied

with the length of the instrument to a maximum of thirty-five minutes. A flexible time period of ten to fifteen minutes was set aside at the end of each testing session for the purpose of in-class test correction. Unit tests comprised most of the same item types included in the summative evaluations and student performance was qualitatively defined by means of an "M", for the mastery of unit materials, and of an "N/M" for the nonmastery of such materials. Ungraded unit tests were carried out in relation to learning materials presented over a given unit of instruction but, on occasion, provisions could be made for the inclusion of materials covered in previous units of learning as part of a broader diagnostic devised to describe ongoing individual student status in relation to subject matter previously mastered.

CHAPTER IV

RESULTS

As shown in Figure 7, the present study comprised three groups of subjects assigned to four different treatment conditions. Groups I (n=40) and III (n=72) were assigned, respectively, to the mastery and nonmastery conditions while Group II (n=29), described here as a quasi-mastery group, received sequenced instruction, based on structured hierarchies and unit tests. Subjects in this group were deprived of feedback on the unit tests during the first half of the experiment but were provided with immediate knowledge of results during the second half of the study. All groups were administered two achievement tests--summative evaluation I in the middle of the instructional period and summative evaluation II at the end. However, within Group II, the same subjects being exposed to two different treatment conditions, only one achievement measure was used per treatment. The achievement measure for treatment #2 was summative evaluation I while the dependent measure for treatment #3 was summative evaluation II. Group III (n=72) received instruction by the conventional method of lecture discussion. There were two subgroups within Group III: (a) those who received a pretest in advance of the instruction (n=40) and (b) those who were provided instruction without being administered the pretest (n=32). A brief description of the differences in treatments is also included in Figure 7.

The basic research questions posed at this point were:

1. Can the Bloom mastery method used with first year university

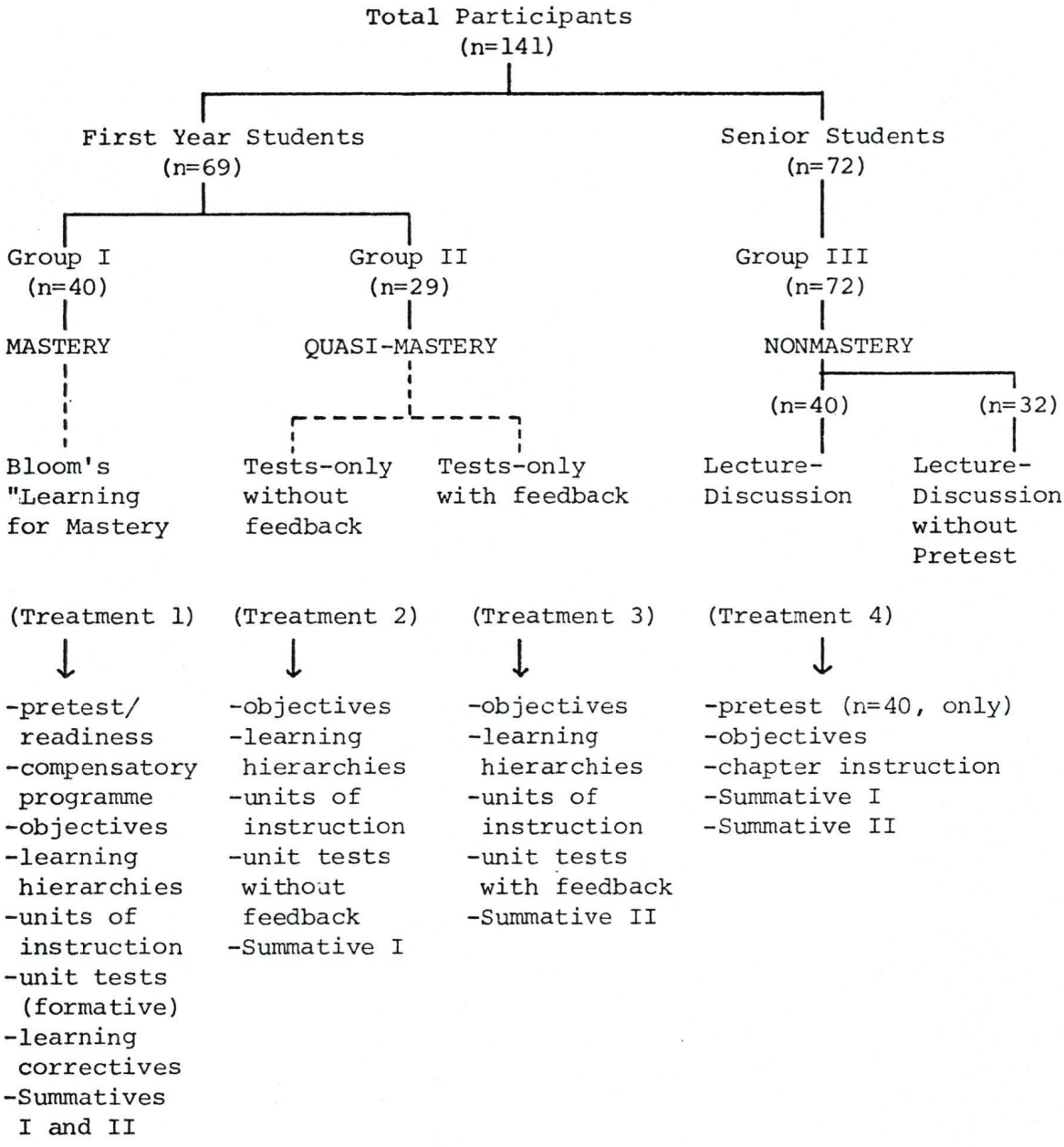


Figure 7. Assignment of subjects by group and treatment.

students (younger) by itself compensate for their lack of experience with course-related subject matter and objective testing procedures (older students)?

2. Is the full "mastery" treatment superior to the learning correctives-deprived "quasi-mastery" procedure when knowledge of results on unit tests is both provided and withheld?

3. Is achievement likely to differ between students in the quasi-mastery group (n=29) and students in the nonmastery control (n=32) given that the difference between these groups is a matter not only of treatment control (no pretest or mastery requirement on both) but also of experience in related courses?

4. Does learning by the mastery approach have a positive effect in improving student attitude towards the subject matter; in effect, is there a significant difference in attitude towards the course whenever students engaged in the full mastery treatment are compared with those learning the same materials under the two quasi-mastery conditions?

Aside from these basic questions, there was also the question, inspired by the research design, of whether retaining the unit tests, such that they were not made available for study, affected student achievement in the mastery condition.

In relation to questions #2 and #3, the reader is reminded that a single group of subjects (n=29) was assigned to two different quasi-mastery treatment conditions--unit tests without feedback and unit tests with feedback. The reader is further reminded that, in the grand design, two groups of subjects were initially made available (n_1=69; n_2=72) and that (because of time-table problems) subjects were

randomly assigned to the mastery condition (n=40) from the (younger) group of 69 students and to the nonmastery condition (n=40) from the (older) group of 72 students. The 29 students remaining in the younger group (n=69) following the assignment of subjects to the mastery condition were chosen to engage in quasi-mastery learning (treatments #2 and #3), thus ensuring that the subjects assigned to the partial mastery treatments came from the same population as the mastery students (younger). Subjects assigned to the mastery and nonmastery conditions were in effect the only ones drawn from different populations (younger vs. older students).

Also, in relation to the last question, it is important to remember that, during the second part of the experiment, students corrected their own unit tests and that, upon the completion of each correction procedure, the tests were collected and retained by the instructor, being subsequently made available to the mastery subjects requiring correctives only within the time limit set for the remediation of their learning deficiencies.

In turning the reader's attention to the major findings, it is important to stress that the present study is primarily concerned with the comparison between the mastery and the nonmastery groups (n=40; n=40) in terms of the subject's performance to the mastery level of 80 percent in the summative tests. The mean differences in scores on summatives I and II in these two groups were so insignificant (less than .20) that a decision was made to combine the scores on these tests (summatives I and II) for purposes of statistical analysis. Additionally, the mean differences in score between the nonmastery subgroups (with

pretest, n=40; without pretest, n=32) were equally insignificant (less than .21) and, on this basis, the nonmastery subgroups were combined to form a single control for the purpsoe of the chi-square comparison. Combining the groups in this way, however, affected the comparison between the mastery and nonmastery treatments as shown later (Table 2).

The chi-square comparison proceeded on the basis of the number of subjects in each treatment condition achieving to specified performance brackets (80%-100%; 60%-79%; <60%) on the summative tests (Table 1).

Combining individual scores on summatives I and II for subjects in the mastery and nonmastery conditions and considering the two nonmastery subgroups together (n_1=40; n_2=32) made for a more valid comparison. Table 2 illustrates the extent to which combining individual scores on summatives I and II for subjects in the mastery and nonmastery conditions reduced the number of students scoring at or above the 80 percent mastery level of achievement.

A comparison of observed to expected frequencies of the number of subjects in the different learning conditions achieving the three levels of performance specified in Table 1 (80%-100%; 60%-79%; <60%) reveals that while the number of subjects in the mastery condition scoring at or above the 80 percent mastery level was much higher than expected, the number of students in the nonmastery condition scoring at this level was very much less than the expected frequency. Conversely, as shown in Table 3, the number of students in the mastery condition scoring less than 60 percent was lower than the expected frequency while the nonmastery students, as a rule, produced much more than the expected frequencies at the lower end of the scale.

Table 1

Number of Subjects per Treatment Condition Achieving to Specified Levels of Performance on the Dependent Measures

	Groups			
	Mastery (n=40)	Quasi-Mastery (n=29)		Nonmastery (n=72)
Treatments / Performance Brackets	Bloom "Learning for Mastery" (Summ. I & II)	Tests-Only with Feedback (Summ. II)	Tests-only without Feedback (Summ. I)	Conventional Lecture Discussion (Summ. I & II)
80% - 100%	15	13	1	10
60% - 79%	24	13	22	48
< 60%	1	3	6	14

$x^2 = 26.70$; d.f. = 6; $p < .01$

Table 2

Number of Subjects in the Mastery and Nonmastery Conditions Achieving Mastery on the Basis of Each Summative Test Considered Separately and on the Basis of Combined Summative I and II Scores

	Test		
Condition	Summative I	Summative II	Combined Summatives I & II
Mastery (n=40)	20/40 = 50%	18/40 = 45%	15/40 = 37.5%
Nonmastery (n=72)	16/72 = 22%	16/72 = 22%	10/72 = 14%

It is thus clear that the treatment groups differ significantly in achieving mastery ($p<.01$) whenever the number of subjects attaining to the 80 percent mastery criterion is used as a basis for analysis.

Table 3 shows the averages on the pretest and the two summative evaluations and includes the combined (summatives I and II) mean scores for the mastery and both subgroups of the nonmastery conditions.

The difference in test performance between students assigned to the two nonmastery subgroups (with pretest, n=40; without pretest, n=32) was not significant with respect to summative I ($F=.08$; d.f. 1, 70; $p>.05$). This finding indicates that, whenever exposed to exactly the same treatment, pretested subjects did not outscore the pretest deprived students. It follows that there was no "shaping" effect produced by the pretest, at least within the nonmastery group. Whether there was such an effect between the pretested mastery students (n=40) and the non-pretested quasi-mastery subjects (n=29) could not be determined: different treatments, producing different outcomes, were involved. However, a chi-square test carried out on the score distribution (above and below the median; n=80) revealed no significant difference in pretest performance between those learning for mastery (n=40) and those learning under the conventional method of lecture discussion (n=40), $x^2=2.00$; d.f.=1; $p>.05$. It is, thus, reasonable to assume that, had subjects assigned to the mastery and quasi-mastery conditions learned by the same method, between treatment differences in summative test performance would have been minimal.

Thus, assuming that (a) pretest administration had no significant effect on summative test performance and that (b) the mean difference

Table 3

Mean Test Scores and Variances for the Different Treatment Conditions on the Pretest and Summatives I and II

		Measures							
		Pretest		Summative I		Summative II		Combined Summatives I & II	
Groups	Treatment	Mean	Var.	Mean	Var.	Mean	Var.	Mean	Var.
I (n=40)	Mastery (n=40)	03.21	3.80	15.00	4.82	14.80	4.57	29.85	12.49
II (n=29	Tests/Feedback	-	-	-	-	14.62	4.60	-	-
	Tests/No Feedback	-	-	12.66	3.45	-	-	-	-
III (n=40)	Nonmastery	03.30	3.20	13.20	8.08	13.30	9.04	26.55	28.15
(n=32)	Nonmastery (no pretest)	-	-	13.41	5.93	13.50	6.90	26.90	20.67

in score on summatives I and II in the mastery and nonmastery conditions were so small as to justify the combined test scores arrangement previously described, a decision was made not to control for the effects of repeated measures in the relevant subsequent analyses. There was, however, a substantial mean difference in score between Summatives I and II in the quasi-mastery group (Table 3). This difference may be reasonably attributed to the differences in the treatments (#2 and #3) to which this group was subjected and not to a practice effect due to tests. Insignificant differences in mean scores on Summatives I and II were evident in those cases where the scores of the groups subjected to a single treatment were compared. This is true both of the mastery and nonmastery groups.

A one-way analysis of variance was used to check for the significance of the results obtained so far. It should be stressed again that the main comparison is between the mastery and nonmastery groups (n=40; n=40) and that we are comparing the combined scores on both tests--summatives I and II. The analysis, where it includes the quasi-mastery group (n=29, two treatments) keeps summative test I and II scores separate.

As regards the main comparison, difference in scores for the mastery and nonmastery groups (combined Summatives I and II) was significant ($F=10.72$; d.f. 1,78; $p < .01$). Furthermore, the mean difference in test performance (Summative I) between learning for mastery (the full Bloom approach treatment) and learning the same materials under the first of the quasi-mastery treatments (structured hierarchies with no correctives or feedback on unit tests) was also significant

($F=21.75$; d.f. 1,67; $p<.01$). The mere addition of immediate knowledge of results in the basic quasi-mastery treatment produced test results (Summative II) not different from those obtained by the mastery students ($F=0.51$; d.f. 1,67; $p>.05$). The differences in scores on the summative tests are shown in Figure 8.

To sum up the analysis: (a) there was no significant difference in test performance between learning under the first quasi-mastery treatment (structured hierarchies with no correctives or feedback on unit tests) and learning the same materials under the conventional lecture-discussion approach ($F=1.81$; d.f. 1,59; $p>.05$). Hence, the quasi-mastery students in treatment #2, contrary to our expectation, were not disadvantaged when compared to their older and more sophisticated counterparts in the nonmastery condition (Table 4); (b) the edge gained by the quasi-mastery students under treatment #3 (structured hierarchies and unit tests with feedback) over the nonmastery subjects was not statistically significant ($F=3.29$; d.f. 1,59; $p>.05$); (c) retaining the unit tests during the second half of the experiment (to determine whether the availability of these tests for study was in itself accounting for differences in achievement) had no effect on the outcome scores. The mean differences in score between summatives I and II for subjects in this group was only 0.20; (d) as regards the affective criterion (questionnaire), there was no difference in student attitude between learning for mastery by the Bloom method and learning the same subject matter under the quasi-mastery treatments ($F=3.90$; d.f. 1,67; $p>.05$). Although the difference was not significant, we can perceive a tendency for the full mastery treatment students to

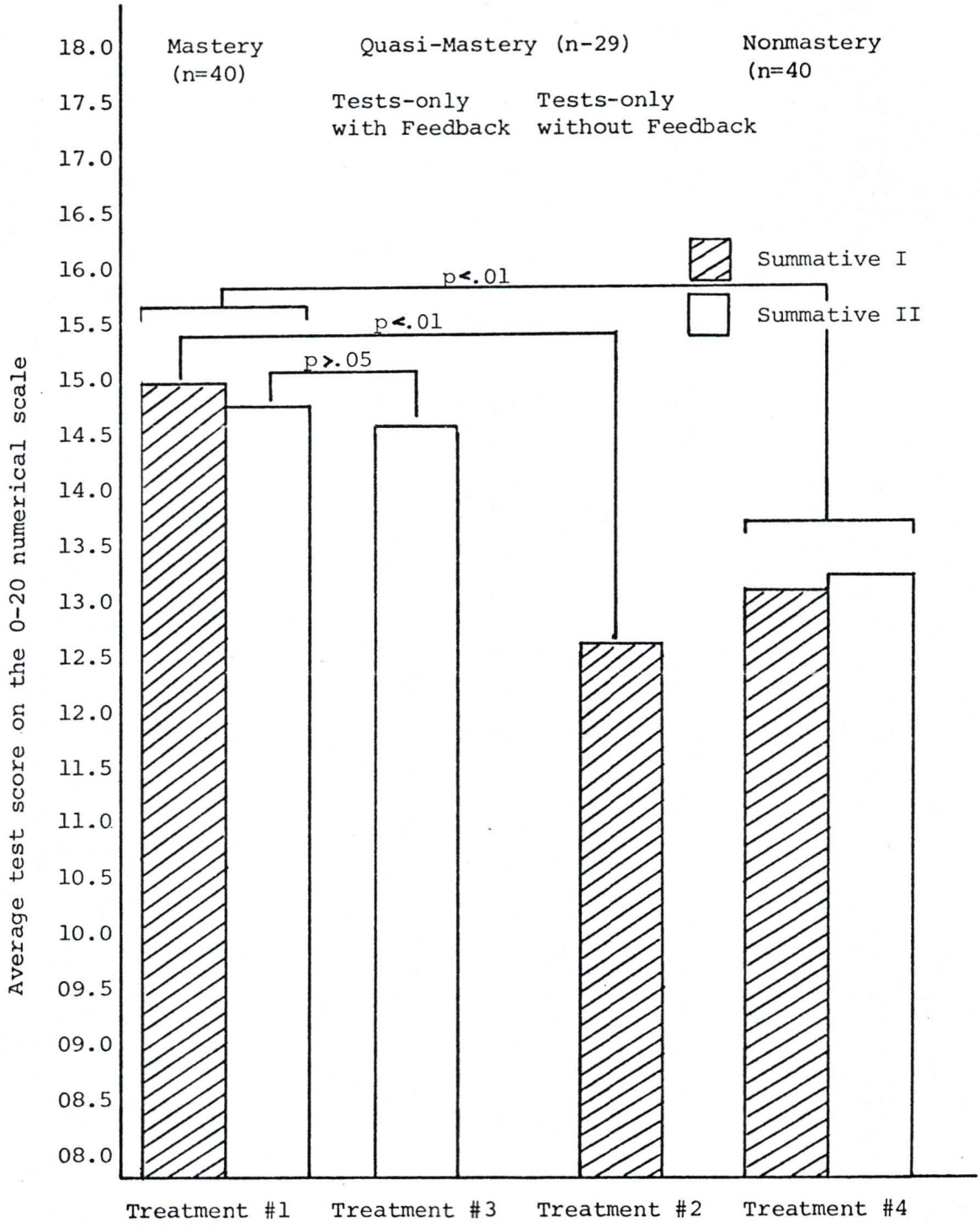


Figure 8. Average Scores of Subjects Assigned to the Four Treatment Conditions on Summative Evaluations I and II.

Table 4

Mean Scores for the Quasi-Mastery Group (Both Treatments, No Pretest) Compared to Nonmastery Subgroup #2 (No Pretest) on Summative Tests I and II

	Groups		
	Quasi-Mastery (n=29)		Nonmastery (n=32)
Treatments	#3: Tests-only with Feedback	#2: Tests only without Feedback	#4: Conventional Lecture/ Discussion
Tests			
Summative I	. . .	12.66	13.41
Summative II	14.62	. . .	13.50

score higher on the questionnaire than the quasi-mastery students. This refers to the measure as a whole. This tendency is shown more clearly in Table 5 where the four questions which refer to the instructional features of the mastery method have been isolated (items #12, #13, #14 and #16, respectively). It is relevant to note that the two groups scored further apart on questions #14 and #16--which refer to the expected grade and attitude to the course as a learning experience.

In treatments #1 and #3 (mastery and tests-only with feedback) it is noticeable that subjects scoring less than 60 percent on the summative measures all failed, with a single exception, to become involved with the specific mastery components of their treatment condition. On the other hand, 90 percent of the subjects learning for mastery generally performed to the stipulated criterion of achievement on each unit. The single exception was in unit #3 where only 87.50 percent of the subjects in the mastery condition demonstrated mastery (Table 6). However, the difference between the number of subjects in unit #3 achieving the 80 percent mastery level after correctives (n=35) and the total number required for unit progression (n=36) was judged so insignificant as not to warrant further corrective efforts. Table 6 provides a complete description of the percentage of subjects assigned to the mastery condition scoring above and below the specified level of mastery performance or missing each unit's formative test altogether. It also includes the overall percentage of students attaining or failing to attain mastery after completing the relevant corrective measures.

There is no clear pattern in the table nor any development in the percentages achieving mastery as the learning experience progresses.

Table 5

Percentage of Students Scoring at the Top Level of the Full Scale on Four Questions Dealing Specifically with "Mastery" Features

Item No. and Description	Groups	
	Mastery (n=40)	Quasi-Mastery (n=29)
#12. Willingness to take another university course by the same method. *	85.00	89.66
#13. Completion of mastery related instructional features will influence course performance.	85.00	82.76
#14. Personal learning experience greater by present method than by conventional approach.	95.00	82.76
#16. Final grade for present course lower if instruction had occurred solely on the basis of lecture discussion.	97.50	89.65

* see Appendix N for description in greater detail.

Table 7

Percentage in the Tests-Only With Feedback Condition Who Completed the Prescribed Unit Tests

Status	Unit Tests		
	IV	V	VI
Took the test	86.21	82.76	79.31
Missed the test	13.79	17.24	20.69
Total (%)	100	100	100

It is, however, possible to identify a tendency for the students performing to criterion on the unit formative evaluations to decrease in number as the learning experience progresses in time.

Generally, over 80 percent of the subjects in treatment #3 (tests-only with feedback) were available for tests at the appointed times and received knowledge of results on performance thereafter (units #4, #5 and #6). The percentage of subjects in treatment #3 who presented themselves for tests and who were subsequently informed of their results is indicated in Table 7.

Assuming that the degree of involvement in the mastery method accounts for the students' performance on summatives I and II (and this seems a reasonable conclusion to draw), the overall results clearly establish the superiority of the mastery method in this case.

Table 6

Percentages of Mastery Subjects Achieving Mastery on the Formative Measures

	Formative Evaluations											
	I		II		III		IV		V		VI	
Initial/ Post-Corrective	Init.	P.C.	Init.	P.C.	Init.	P.C.	Init.	P.C.	Init.	P.C.	Init.	P.C.
Performance Levels												
Attained Mastery	65	92.5	22.5	90	37.5	87.5	17.5	90	25	95	17.5	97.5
Failed to Attain Mastery	30	...	72.5	...	60	...	75	...	67.5	...	77.5	...
Missed Test	5	7.5	5	10	2.5	12.5	7.5	10	7.5	5	5	2.5
Total (%)	100	100	100	100	100	100	100	100	100	100	100	100

CHAPTER V

DISCUSSION

Limitations of the Study

Notwithstanding the significant differences in achievement, we must exercise caution in interpreting the results of the present experiment. First of all, the study was confounded by the arbitrary assignment of the subjects to two timetable groups (R.A.1 and R.A.2). This initial division of the subjects forced us to randomize only within these assigned groups: we could not deal with the total group of subjects as a single entity. Lack of resources prevented the researcher from ensuring that all subjects had an equal chance of learning exposed to either the mastery or the nonmastery treatments. The random assignment to groups for these treatments therefore resulted in relatively younger students learning assigned to the mastery treatment and the more sophisticated, or experienced, students learning assigned to the nonmastery condition.

It is obvious that assigning subjects to the mastery and nonmastery conditions on the basis of this arbitrary division into sections where younger students received the mastery treatment and the more experienced students received the traditional lecture-discussion treatment could readily offset the effects of mastery by virtue of the greater experience and greater test sophistication which one or more years at the university are bound to produce.

There is no way of knowing whether the differences obtained are due to the power of the mastery method to compensate for lower levels

of sophistication with university courses or whether they are due to such extraneous factors as freshness of approach differences in effort and commitment (non-cognitive).

Notwithstanding the confounding age factor in the present research design, we still managed to show that significant differences in achievement between the mastery and nonmastery subjects manifestly appeared regardless of the arbitrary assignment to course sections.

Because of the design of the experiment, we ensured a comparison between (a) the full mastery condition, (b) the full nonmastery condition and (c) a quasi-mastery treatment which, by hopothesis, was not very different from the nonmastery condition. The hypothesis was verified. We may thus conclude that removing certain elements from the mastery programme reduces its effectiveness to the level of the traditional lecture-discussion method.

The fact that younger students in the first quasi-mastery treatment (#2) showed no significant differences in score from their older nonmastery cohorts suggests that the observed differences in achievement ($p<.01$) between the mastery and nonmastery groups were most probably due to treatment rather than to age differences between the groups. This is indicated by the significant differences in achievement found between learning for mastery and learning under the first quasi-mastery treatment.

Contrary to our expectations, age and maturity of experience do not compensate for the known deficiencies of the lecture method (McLeish, 1976).

Whether the failure of the nonmastery subjects to significantly outscore the quasi-mastery students in treatment #2 was due to such noncognitive factors as freshness of approach differences in effort and commitment could not be established in the present study and is, therefore, for future research to decide. What remains clear, in this case, is the fact that learning on the basis of structured hierarchies (treatment #2) is no different from learning under chapter based instruction (conventional) in which case the expected differences in experience and test sophistication between the younger and older students are not apparent.

But the present study may also be confounded by contamination. By this we mean information between subjects assigned to the different treatment conditions. This potential for contamination was much greater between the two randomly chosen groups derived from the first section (younger students, n=69) since these groups were derived from the same population and were assigned different treatments while attending the same lectures. Thus, the mastery and quasi-mastery groups in the case of this section spent a good deal of time together in lectures.

Under these conditions, no control could be imposed to prevent cooperative study of mastery materials outside of the period of formal instruction.

It is entirely possible too, that this contamination effect spread across both sections (younger/older). The university population is both small and made up of a considerable number of out-of-town students who reside mostly in campus housing and foregather in various leisure pursuits.

Still, the results obtained reveal that students in the mastery condition scored significantly higher than students both in the non-mastery condition and in the first quasi-mastery treatment. This suggests that the exchange of information between subjects from the different treatment conditions was either minimal or of little consequence, perhaps because neither the quasi-mastery subjects nor the nonmastery students were given the opportunity to apply any such information, formally, in the full mastery context.

With respect to the second quasi-mastery treatment (#3), we have already declared that this treatment is essentially the same as the full mastery approach which merely contains the added provision of instructional correctives. The question of contimaination in this group is therefore not so vital as is contamination in the comparison between the mastery treatment and either the nonmastery condition or the quasi-mastery treatment #2.

There are other limitations which advise further caution in drawing conclusions from the present results. In the first place, there is the possibility that the difference in achievement between the students in the quasi-mastery group could have been due to order effects. The two treatments in this group were assigned to the same students in order of increasing complexity. Unfortunately, it was not possible to allow for, or to measure, the effect of order of presentation.

We must also mention the possibility of cheating during the tests. Strict budget limitations prevented the application of the Acker and Goldwater (1973) procedure for obviating classroom cheating on objective type tests. The use of this procedure in the present study was all the more relevant since students assigned to both the mastery and the

quasi-mastery conditions were tested together in the same room and the summative tests comprised mostly objective type items.

There was however no overt evidence of cheating on the summative tests. Results show that students in the first quasi-mastery treatment scored essentially the same as the nonmastery students (both assigned to treatments producing similar outcomes) while being tested separately. Also, the same quasi-mastery students, when compared to the mastery subjects with whom they were tested, produced the largest difference in achievement obtained in the entire experiment. This could result from the fact that all students were tested in the amphitheater under a spacious exam-type desk arrangement and close supervision.

Furthermore, giving more accurate behavioural descriptions (objectives) to the subjects in the mastery and quasi-mastery conditions may account for differences as between the nonmastery condition and the various mastery conditions. Still, this extra simplification of learning outcomes did not seem to place the nonmastery students learning on the basis of the fifty-three original outcomes at any disadvantage in relation to the quasi-mastery subjects for whom the objectives were further defined. This is revealed in the comparison of summative I test results for these groups.

Notwithstanding the further specification of the behavioural descriptions relevant to each of the hierarchies of learning identified in treatment #2, subjects in the nonmastery group even managed to outscore (although not significantly) their younger quasi-mastery cohorts learning with the aid of the more concise descriptions. In any case, the author would have been prepared to defend the role of

behavioural objectives, specified by task and task elements, as an integral part of the mastery method but not of conventional instruction.

The Significance of the Results Obtained

It is clear that the existence of possible confounding factors and the possible contamination of our procedures does not cast doubt on the significance of the results obtained. However, it would be wise to limit our discussion to the specific situation at the University of the Azores. The original aim of this study was indeed to provide a mastery learning experience for secondary school teachers in training at the University and to evaluate the merits of this system.

It is reasonable to appreciate from our materials the powerful impact of Bloom's "Learning for Mastery" strategy on student achievement. Our results are comparable with those of previous studies (Collins, 1970; Moore, Mahan & Ritts, 1969; McMichael & Corey, 1969; Sheppard & MacDermott, 1970; Goldwater & Acker, 1975; Calhun, 1976). Many other papers could be cited such as Bloom and Keller-PSI type studies involving subjects at the university level.

Our results are also consistent with those of Kim et al. (1971) and Lee et al. (1971). In much the same way as the present author, these authors sought to apply a Bloom type strategy in teaching subjects other than North American students. It is relevant to note that the studies referred to are of particular interest since they were carried out in countries other than Canada or the United States. They also involved large sample sizes and produced similar differences in both the mastery and the nonmastery conditions, but (in Kim's case) these

differences were smaller than those reported here. Kim et al. collected data from 5800 subjects. Lee et al. involved 12000 students in their study. With such numbers, a difference of a few percentage points can be highly significant.

In our study there was no difference in the number of students scoring above and below the 80 percent mastery level for the mastery condition. Half of the subjects assigned to Group 1 attained the 80 percent performance criterion in Summative evaluation I. In the nonmastery condition, those achieving to criterion were separated from those scoring below 80 percent by a difference of 55 percentage points. In this instance, only about one-fifth of the students engaged in conventional learning procedures managed to achieve the high performance level attained by half of the students learning by the full mastery method (Summative I).

The present results confirm the predictions made by Bloom (1974) who estimated that only about one-fifth of the students engaged in conventional learning would manage to achieve to the high performance level normally attained by about four-fifths of the students learning for mastery. Note that, in the present study, only one-half (and not four-fifths) of the mastery students achieved to criterion in summative I. The author speculates that the reason for this stems from the fact that the learning hierarchies defined were too self-contained within each of the instructional periods preceeding the two summative evaluations. As a result, the comulative effect of sequential learning was not realized.

Instead of building on the first period (up to Summative I), learning during the second instructional phase occurred almost independently of this earlier period. In fact, it was more like a new parallel experience than a comulative one built on the earlier foundations. This hypothesis becomes more feasible when we realize that the course content varied substantially from the first to the second part of the experiment. It is reasonable to predict that, had instruction proceeded without a break in the middle, the percentage of students achieving to criterion in the mastery condition would have been considerably higher.

The reported differentials in achievement between the mastery and nonmastery subjects are meaningful as well as statistically significant. The large number of subjects scoring at the top levels of the attitude scale (affective questionnaire) demonstrate a strong positive affect towards the mastery method. The stabilization of grades at the highest level in the students under this treatment (similar to the stability of low grades in students under conventional methods), so ably demonstrated by Bloom (1964), suggests the source of this positive adience. There is, in fact, little need to pursue the evaluation by grades from the standpoint of how well the students are succeeding in comparison to each other: the grading system becomes almost entirely motivational in purpose.

Success, achieved in a noncompetitive learning situation or environment, is bound to have positive effects on students. Their interest in the subject and their attitude towards learning are changed. Research in this area indicates this point: that the interest and

attitude concomitants of mastery learning depend on the level of performance achieved by students (Block, 1972). Bormuth (1969) and Sherman (1967) also suggest that a mastery strategy, demanding near perfect performance, will not produce best results in increasing interest in and positive attitudes towards learning. In his second review of the literature on mastery learning, Block (1974) concludes that greatest interest results in those instances where the performance criterion is set at 80 percent. This, of course, was the case in the present study.

Although we did not design the present study to measure individual differences, we have data which answers the question of whether individual differences in achievement are reduced under the mastery method. Our results show a difference of 11.92 points(variance) between mastery and nonmastery on the two summative tests combined. These differences were already evident on the very early. This suggests that even before the first summative evaluation, the mastery scores were already unrelated to the pretest scores. On the other hand, in the nonmastery condition students' scores continued to be related to their pretest results. Block (1970; 1972) reported that with continuing higher achievement, the smaller became the variance. This is entirely consistent with the highly skewed distribution of scores often attributed to the mastery method (see Figures 1 and 2).

There is also considerable evidence that students take considerably less time to achieve the criterion score the longer they continue in the mastery method. The efficacy of the mastery method in bringing students of varying initial aptitudes to more uniform levels of

performance is clearly demonstrated. However the present results were contrary to expectation (based on Bloom, 1974) insofar as there was a tendency for the numbers performing to criterion to decrease as the course proceeded. Two possible reasons for this suggest themselves. First, the definition of learning during the two phases of instruction, marked by summative tests I and II, may have ruptured the learning continuum. Secondly, on realizing that there was no penalty for below criterion performance on the formative tests, students in the mastery condition may well have adopted a wait-and-see policy: when we know our formative evaluation score, we can bring to bear our knowledge of the corrective instructions to achieve a better score second time around. There is reason to believe that both possibilities are plausible explanations of this effect.

It is clear that learning by the full mastery method is not the same as learning by partial mastery. When we deemphasize some of the instructional features inherent in the method, learning suffers. This result is consistent with other evidence pointing to the undesirability of dropping any instructional features from the basic mastery procedures (Calhun, 1976). However we found no significant difference between scores attained under the full Bloom treatment (Group I) and scores attained under the second quasi-mastery treatment (Group II). This was, of course, the learning condition which most closely resembled the full mastery treatment. It contained all of the mastery features except for the corrective component. This finding is consistent with at least two other reports.

Lee et al. (1971) concluded from their research in Korea that a small group cooperative learning experience (one possible mode of

correction in the Bloom strategies) was not an essential component so far as high achievement was concerned. However, these authors insisted that their study required replication.

Tierney (1973) came to the same conclusion. Undertaking a comparison of feedback/correction procedures as these are used in mastery strategies (Bloom & Keller), he reported that the use of feedback/correction procedures in themselves had no impact upon student achievement.

It must be remembered that Tierney did not employ a mastery learning strategy in his study. He was concerned merely with a comparison of two variations of correctives. The present study compares a full mastery treatment with two variations. We therefore conclude that, as results by Collins and Kim suggest, feedback/correction procedures are perhaps most effective when used in the mastery context of pretesting and disclosure of objectives.

In the present study, pretesting and disclosure of course objectives should have made for a significant difference in achievement between the full mastery treatment and its corrective deprived variant. This did not happen, however. It is possible that, to an unknown degree, the quasi-mastery subjects (treatment #3), once provided with knowledge of results, proceeded to correct not only their own deficiencies but may have also involved in the process some of those in the Bloom mastery condition. If such was the case, they too would have been learning under the full mastery method. It should also be noted that an increased number of students in the quasi-mastery group, while learning under treatment #3, sought the instructor's help

following the unit tests and that this help was provided to all who asked for it.

Conclusions

Without attempting to generalize our results, we may permit ourselves the following conclusions:

A significant difference in achievement was found between (younger and older) students who learned for mastery or by the traditional method respectively. However, we cannot conclude that the method compensated for the lack of experience of previous courses and lower test sophistication in the younger group. It was impossible to disentangle the influence of the age factor because of the confounding of the research design by the assignment of the course sections to intact groups of students. It would have been necessary to duplicate instruction (because of timetable problems) had we randomized the two assigned sections.

However, it is evident from the grades achieved and the affective questionnaire that the Bloom method is superior to the nonmastery and to the partial mastery procedures adopted in this study. When knowledge of results on unit tests is withheld, students do not do so well as under the full mastery treatment.

The failure of the design to produce significant difference in achievement between subjects learning by the conventional method as opposed to the quasi-mastery method where students are not provided with knowledge of results (treatment #2) suggests that the differences in experience and test sophistication between the younger and the older students were being overlaid by some other variables.

When knowledge of results is provided to the quasi-mastery group (the full mastery treatment except for correctives), the differences in score between this group and those in the full mastery treatment are no longer significant. Whatever small advantage (not significant) the nonmastery students (older) may have over the younger quasi-mastery subjects, while these learn without provisions for knowledge of results on unit tests, is reversed (although still not significantly) when the younger students receive the supplemented quasi-mastery treatment (#3). A significant difference in achievement was found by Calhun when students in the full Keller approach were compared with other subjects in a Keller treatment minus one of its features. It should be remembered, however, that the feature dropped by Calhun was not correctives but the division into units of instruction (hierarchies). Whether dropping knowledge of results and the other proctor/student interactions could have had the same effect remains a matter for speculation.

Collins, on the other hand, makes a clear-cut case for the effects that specific review procedures (i.e., learning correctives) have on achievement. Here too, it must be remembered that the subjects were pretested. However, in the present study the pretest probably had no influence on the subsequent summative performance. No conclusion can be drawn from our study about the effectiveness of learning correctives in student learning. The small differences involved are not significant statistically nor is it possible to clarify the effects of confounding.

Taking the study as a whole, it seems safe to conclude that the instructional features of the Bloom method proved themselves to be most effective when applied as a single integrated strategy. This was the opinion expressed by the subjects in their answers to the affective questionnaire. Their responses to the items relating directly to the features inherent in mastery learning reveal this. Judging from comments made by some subjects, we may conclude that the present study attained its primary goal of revealing a workable alternative to current instructional practice at the university and secondary school levels in the Azores.

The participants acknowledged the feasibility of the method from their personal experience of it. It remains for the author to hope that the prospective teachers who were subjected to this experience will learn from it, not perhaps to the extent of duplicating these procedures in future classroom situations (as the author initially hoped they would) but more importantly, by realizing that it is every educator's responsibility to seek and implement the most productive and situation-optimal methods. The author believes that current social concerns in the Azores could best be addressed by the wide-spread implementation of efficient, and therefore addictive, mass education. This could be undertaken in the conventional classroom setting but using a method which places responsibility for learning more firmly on the student's shoulders than does the conventional method.

The author hopes that the present study will serve those officials who, for the first time, have received a mandate from the Azorean

people, enabling them to decide future educational policy in the Islands on criteria which are primarily educational.

Suggestions for Further Research

The present study is the first ever carried out in the Azores in the area of mastery learning. It would be most opportune to provide a replication to confirm or refute the results obtained. It is suggested, however, that, in any replication, the present limitations of design be avoided.

It would also be relevant to use groups of subjects from different learning levels and from different subject areas. It would then become possible to generalize the results. We could then decide the question of mastery method as a feasible alternative to the conventional methods of instruction.

In fact, the pressing need for research on mastery learning in areas other than psychology and the objective sciences (in which areas learning hierarchies can most easily be identified) has been established by earlier researchers. Tierney, for instance, has called for the extension of mastery learning research into the humanities where the sequencing of materials is not so easily accomplished. Until research workers can successfully demonstrate that the effectiveness of mastery learning is not determined primarily by subject matter, the advantages of the mastery method remain in doubt.

Another limitation of the present study, which could be overcome by future research in the Azores, is that of restricted performance criteria. In view of certain logistic problems, it was not possible in the present research to study retention and transfer. Future

research on mastery learning in the Azores should seek to establish the effectiveness of this method not only in terms of student achievement, but also on student retention and application of the materials learned.

Finally the whole matter of individual differences in learning could be clarified by further, more specialized research. It has already been established that the variation in time needed by subjects to attain mastery is pronounced (Bloom, 1974). As such a careful record of the different experiences needed by each student to attain unit mastery whould show whether the difference between students in the amount of extra time needed would diminish in the course of studies. Such records would be relatively easy to obtain. For example, the number of times a given student signed up for correctives on the different units, or the number of times he/she may have required extra help could easily be recorded and analyzed. It is an interesting question whether learning to a specific criterion of performance over a period would result in students becoming more alike in learning efficiency level and whether the improvement in learning would transfer to other subjects.

BIBLIOGRAPHY

Acker, L.E., & Goldwater, B.C. A written exam procedure to minimize in-class cheating. Journal of Applied Behaviour Analysis, 1973, 6, 540.

Airasian, P.W. (1967) An application of a modified version of John Carroll's model of school learning. Unpublished master's thesis. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Airasian, P.W. (1969) Formative evaluation instruments: A construction and validation of tests to evaluate learning over short time periods. Unpublished doctoral dissertation. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Airasian, P.W. The role of evaluation in mastery learning. In J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Anderson, L.W. (1973) Time and school learning. Unpublished doctoral dissertation. Reviewed in J.H. Block (Ed.), Schools, society and mastery learning. New York: Holt, Rinehart & Winston, 1974.

Ausubel, D.P. How reversible are the cognitive and motivational effects of cultural depriviation. Urban Education, 1964, 1, 16-38.

Barrere, M., & Glasgow, R.E. Design and evaluation of a personalized instruction course in behavioural self-control. Teaching of Psychology, 1976, 3, 81-84.

Behr, M.J. A study of interactions between 'structure-of-intellect' factors and two methods of presenting concepts of modules seven arithmetic. Unpublished doctoral dissertation, Florida State University, 1967.

Bormuth, J.R. Development of readability analysis. ERIC Document No. ED029166, 1969.

Bormuth, J.R. Development of standards of readability: Towards a rational criterion of passage performance. ERIC Document No. ED 054233, 1971.

Born, D.G. et al. Examination performance in lecture-discussion and personalized instruction courses. Journal of Applied Behavior Analysis, 1972, 5, 33-43.

Block, J.H. The effects of various levels of performance on selected cognitive, affective and time variables. Unpublished doctoral dissertation, University of Chicago, 1970.

Block, J.H. (Ed.). Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Block, J.H. Student learning and the setting of mastery performance standards. Educational Horizons, 1972, 50, 183-191.

Block, J.H. (Ed.). Schools, society and mastery learning. New York: Holt, Rinehart and Winston, 1974.

Bloom, B.S. et al. Taxonomy of educational objectives: The cognitive domain. New York: David McKay, 1956.

Bloom, B.S. Stability and change in human characteristics. New York: John Wiley & Sons, 1964.

Bloom, B.S. Affective consequences of school achievement. In J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Bloom, B.S. An introduction to mastery learning theory. In J.H. Block (Ed.), Schools, society and mastery learning. New York: Holt, Rinehart & Winston, 1974.

Calhun, J.F. The combination of elements in the personalized system of instruction. The Teaching of Psychology, 1976, 3, 73-76.

Carroll, J.B. A model of school learning. Teachers College Record, 1963, 64, 723-733.

Carroll, J.B. Problems of measurement related to the concept of learning for mastery. In J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Carroll, J.B., & Spearitt, D. A study of a model of school learning. Monograph No. 4, Harvard University Center for Research and Development of Educational Differences, 1967.

Collins, K.M. (1969) A strategy for mastery learning in freshman mathematics. Unpublished study. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Collins, K.M. (1970) A strategy for mastery learning in modern mathematics. Unpublished study. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Cruzeiro, M.E., & Autunes, M.C. Ensino secundário: Duas populações, duas escolas (I). Análise Social, 1978, 55, 443-502.

Davis, J.B. (1967) An investigation of the interaction of certain instructional strategies with the structure of basic mental

abilities in the learning of some mathematical operations. Unpublished doctoral dissertation. Reviewed in J.H. Block, (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Deutsch, M. The disadvantaged child and the learning process. In M. Deutsch (Ed.), The disadvantaged child. New York: Basic Books, 1967.

Direcção-Geral do Ensino Secundário. Ministério da Educação e Investigação Científica Circular L/T/ES-52/79, 1979.

Ferster, C.B. Individualized instruction in a large introductory psychology college course. Psychological Record, 1968, 18, 521-532.

Gagné, R.M., & Paradise, N.E. Abilities and learning sets in knowledge acquisition. Psychological Monographs, 1961, 75, #518.

Gaynor, J.F., & Wolkin, W.D. The effectiveness of currently enrolled student proctors in an undergraduate special education course. Journal of Applied Behaviour Analysis, 1974, 7, 263-269.

Gentile, J.R. (1970) A mastery strategy for introductory educational psychology. Unpublished study, State University of New York at Buffalo. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Gil, J.F. Relação dos alunos que concluiram a segunda fase do ensino primário e prosseguiram estudos. Angra do Heroísmo, SREC, 1980.

Goldwater, B.C., & Acker, L.E. Instructor-paced, mass-testing for mastery performance in an introductory psychology course. Teaching of Psychology, 1975, 2, 152-155.

Grácio, R. Educação e educadores. Lisboa: Livros Horizonte, 1973.

Green, B. Physics teaching by the Keller plan at MIT. American Journal of Physics, 1971, 39, 764-775.

Havighurst, R.J., & Janke, L.L. Relations between ability and social status in a mid-western community. I. Ten-year old children. Journal of Educational Psychology, 1944, 35, 357-368.

Janke, L.L., & Havighurst, R.J. Relations between ability and social status in a mid-western community. II. Sixteen-year old boys and girls. Journal of Educational Psychology, 1945, 36, 499-509.

Johnson, W.G., Zlotlow, S., Berger, J.L., & Croft, R.G. A traditional lecture fersus a PSI course in personality: Some comparisions. Teaching of Psychology, 1975, 2, 156-158.

Keller, F.S. "Goodbye teacher..." Journal of Applied Behavior Analysis, 1968, 1, 79-89.

Kersh, M.E. (1970) A strategy for mastery learning in fifth grade arithmetic. Unpublished doctoral dissertation. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Kim, H. et al. (1969) A study of the Bloom strategies for mastery learning. Unpublished paper. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Kim, H. (1970) The mastery learning project in the middle schools. Unpublished paper. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winson, 1971.

Kim, H. Mastery learning in the Korean middle schools. UNESCO Regional Office for Education in Asia, 1971, 6, 55-66.

King, I. (1970) A formative development of a unit on proof for use in the elementary school. Technical report. Reviewed in J.H. Block (Ed.), Schools, society and mastery learning. New York: Holt, Rinehart & Winston, 1974.

Kirk, S.A. Early education of the retarded child: An experimental study. Urbana, Ill.: University of Illinois Press, 1958.

Landsheere, G. Definir os objectivos da educação. Lisboa: Moraes Editores, 1976.

Lee, Y.D. et al. Interaction improvement studies on the mastery learning project--final report on the mastery learning program, April-November 1971. Educational Research Center, Seoul National University, 1971.

Lloyd, K.E. Contingency management in university courses. Educational Technology, 1971, 7, 18-23.

MacDonald, F.J. Educational psychology. Belmont, Calif.: Wadsworth, 1965.

Malott, R.W. (Ed.). Research and development in higher education: A technical report of some behavioral research at Western Michigan University. Kalamazoo: Western Michigan University, 1971.

Marshall, J., & Hales, L. Essentials of testing. London: Addison-Wesley, 1972.

Mayo, S.T. et al. (1968) A mastery approach to the evaluation of learning statistics. Unpublished paper. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Melo, A., & Benavente, A. Educação popular em Portugal: 1974-1976. Lisboa: Livros Horizonte, 1978.

Merrill, M.E., Barton, K., & Wood, L.E. Specific review in learning a hierarchical imaginary science. Journal of Educational Psychology, 1970, 61, 102-109.

McLeish, J. The lecture method. In N.L. Gage (Ed.), Psychology of teaching methods. Chicago: National Society for Studies in Education, University of Chicago Press, 1976.

McMichael, J.S., & Corey, J.R. Contingency management in an introductory psychology course produces better learning. Journal of Applied Behavior Analysis, 1974, 7, 87-91.

Miller, L.K. et al. A procedure for maintaining student progress in a personalized university course. Journal of Applied Behavior Analysis, 1974, 7, 87-91.

Mónica, M.F. Educação e sociedade no Portugal de Salazar. Lisboa: Editorial Prensença, 1978.

Moore, J.W., Hauck, W.E., & Gagné, E.D. Acquisition, retention and transfer in an individualized college physics course. Journal of Educational Psychology, 1973, 64, 335-340.

Moore, J.W., Mahan, J.M., & Ritts, C.A. Continuous progress concept of instruction with university students. Psychological Reports, 1969, 25, 887-892.

Partido Popular Democrático. Uma educação para a liberdade. Lisboa: Grupo de Estudos e Comissão Política Distrital de Lisboa-Caderno PPD-3, undated.

Pate, C., & Crittenden, W.B. (1971) The multigrouped nongraded instructional program in Edison Junior High School. Mimeographed manuscript. Reviewed in J.H. Block (Ed.), Schools, society and mastery learning. New York: Holt, Rinehart & Winston, 1974.

Peterson, P. (1972) A review of the research on mastery learning strategies. Unpublished paper. Reviewed in J.H. Block (Ed.), Schools, society and mastery learning. New York: Holt, Rinehart & Winston, 1974.

Riedel, R.C., Harvey, B., & LaFief, W. Unit test scores in PSI versus traditional classes in beginning psychology. Teaching of Psychology, 1976, 3, 76-78.

Rogers, F.M. The Atlantic islanders of the Azores and the Madeiras. North Quincy, Mass.: The Christopher Publishing House, 1975.

Semb, G. The effects of mastery criteria and assignment length on college-student test performance. Journal of Applied Behavior Analysis, 1974, 7, 61-69.

Seashore, H.B., & Bavelas, A. A study of frustration in children. Journal of Genetic Psychology, 1942, 61, 279-314.

Sheppard, W.C., & MacDermott, H.G. Design and evaluation of a programmed course in introductory psychology. Journal of Applied Behavior Analysis, 1970, 3, 5-11.

Sherman, J.G. (1967) Application of reinforcement principles to a college course. Unpublished paper. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Sjogren, D.D. Achievement as a function of study time. American Educational Research Journal, 1967, 4, 337-344.

Skinner, B.F. The science of learning and the art of teaching. Harvard Educational Review, 1954, 24, 86-97.

Smith, H.L., & Eaton, M.T. The relation of retention to speed of learning. Bulletin of the School of Education, Indiana University, 1939, 15, #3.

Sotommayor Cardia, M. Educação e democracia. Lisboa: Secretaria de Estado da Comunicação Social, 1976.

Tierney, M. A comparison of feedback/correction procedures used in mastery learning strategies. Unpublished master's thesis, University of California, Santa Barbara, 1973.

Valente, V.P. Uma educação burguesa. Lisboa: Livros Horizonte, 1974.

Washburne, C.W. Educational measurements as a key to individualizing instruction and promotions. Journal of Educational Research, 1922, 5, 195-206.

Weiner, B. The effects of unsatisfied achievement motivation on persistence and subsequent performance. Journal of Personality, 1965, 33, 428-442.

Wright, W. (1967) Achievement as a function of time: An analysis of selected Stanford achievement test battery results. Unpublished paper. Reviewed in J.H. Block (Ed.), Mastery learning: Theory and practice. New York: Holt, Rinehart & Winston, 1971.

Yeager, J.L., & Kissel, M.A. An investigation of the relationship between selected student characteristics and time required to achieve unit mastery. ERIC Document No. ED 031938, 1969.

APPENDIX A

Differences and Similarities between the Bloom and the Keller Approaches to Mastery Learning and Instruction, as per Block (1974).

Bloom (1968) "Learning for Mastery"	Keller (1968) PSI
Overall Concept of Mastery	
Mastery is defined in terms of student performance taken over all units of instruction put together by means of a summative final examination in which the mastery criterion of achievement is set at the 80 to 85 percent level.	Being based on the unit grade requirement, overall course mastery is determined largely by the number of instructional units completed to criterion by a certain point in time.
Size of the Learning Units	
On the average, two weeks of instruction.	On the average, one week or less of instruction.
Sequencing of Learning Units	
Encourages sequencing of learning units such that materials in one given unit build as much as possible on the materials comprising the preceding unit.	Encourages sequencing of learning units such that materials in one given unit build as much as possible on the materials comprising the preceding unit.
Form of Original Instruction	
Units are taught primarily through group-based methods.	Units are taught primarily through individually-based methods.
Mode of Original Instruction	
Multiple modes of instruction: (a) reading, (b) lectures and (c) discussion. Students are generally held responsible for the materials presented in each mode.	Single mode of learning is emphasized--reading. Lectures and discussions are used sparingly and students are not typically held responsible for the lecture materials.

Pacing of Original Instruction

Original instruction is teacher-paced.	Original instruction is student-paced but contemporary approaches evolving from the basic PSI strategy are instituting controls on pacing as a means of reducing initial procrastination effects.

Unit Feedback Instruments

Formative tests comprise items measuring each of the unit's objectives. Knowledge of each behaviour is tested by one or more test items such that it may be possible to identify precisely just what objectives a given student has attained or failed to attain over each unit of instruction. Perfect performance is not demanded on each formative evaluation.	Formative instruments comprise a given number of items randomly selected from the item-pool designed to test the unit's objectives. The student's performance on the sample is assumed to represent his/her probable performance over the whole item pool. Even though PSI studies often use the 80 or 90 percent achievement criterion, the unit perfection requirement was traditionally upheld as a condition for unit progression.

Mode of Correcting Learning Deficiencies

Learning correctives suggested by individual prescriptions may assume the form of: (a) individual or group tutoring, (b) small group learning activities and (c) other alternative instructional devices. Essentially, instructional correctives tend to present materials in a mode different from that emphasized under the original instruction (see Figure 4).	Tutoring consitutes the primary means of correcting learning deficiencies, the student being typically returned to the original instructional materials for assisted review and restudy.

Adapted from Block (1974, pp. 21-23).

APPENDIX B

Instructional Objectives Formulated for Measurement and Evaluation I (Introductory) and Their Respective Classification in Accordance with the Level of Intellectual Activity Implicit in the Behaviour Term Contained in Each Learning Outcome.

Classification System: Bloom's taxonomy of educational objectives for the Cognitive Domain. Only three classifications were used: knowldege (I), comprehension (II) and application (III).

Objective #1: To appreciate the importance of efficient measurement and evaluation procedures in the overall context of the teaching/learning process.

Learning Outcomes:

II a) Given a cibernetic model of learning and instruction, or any other pertinent flowchart, explain how modern measurement and evaluation procedures relate to effective teaching and efficient learning.

II b) Explain the instructional implications of the following statement: "From the standpoint of pedagogy and pedagogical science, no dissociation . . . [can] . . . be permitted between the overall concept of education and its evaluative component."

III c) Relate the concept of traditional classroom evaluation to school related judgemental processes, to the implicit curriculum and to the possible exertion of teacher influence and control over students.

Objective #2: To understand the importance of formative evaluation in instances where the educator may aim to accommodate varying levels of student aptitude in the context of regular, group-based instruction.

Learning Outcomes:

I a) Define in precise terms what is meant by formative evaluation.

II b) Distinguish between formative and summative evaluation.

I c) Summarize the usefulness of formative evaluation procedures for overcoming specific learning difficulties.

II d) Relate the importance of constructing formative evaluation instruments based on hierarchies of outcomes generated for a specific unit of learning.

e) Enunciate the basic rules which govern the use of formative
I evaluation procedures in classroom situations where instruction is sequentially arranged into learning segments of increasing complexity.

f) Describe the main advantages of using formative evaluation
I procedures in classroom settings of varying student aptitude.

g) Demonstrate the correct use of formative evaluation at relevant
III stages in the teaching/learning process for a given unit of instruction.

Objective #3: To be able to formulate general instructional objectives and specific learning outcomes.

Learning Outcomes:

a) Identify the basic rules which, according to Landsheere,
I determine the effective formulation of learning outcomes.

b) Given a learning outcome, identify its component parts, namely
III the behaviour term and, whenever applicable, the conditions under which the behaviour is to occur and the criterion stipulated degree to which it must occur.

c) Formulate learning outcomes which define both the basic
III behaviour term and the conditions under which the required behaviour is to occur together with the time, quantity or quality criterion deemed necessary to qualify the behaviour.

d) Given the subject matter pertaining to a typical unit of
III learning and instruction, formulate a behavioural objective for each of the main learning tasks comprising the unit together with its respective learning outcomes.

Objective #4: To classify learning outcomes in accordance with the complexity of the intellectual activity implicit in the behaviour term contained in each outcome using Bloom's classification system for the cognitive domain.

Learning Outcomes:

a) Identify the six levels of the classification system devised
I by Benjamin Bloom for the hierarchical ordering of learning outcomes on the basis of the intellectual activity implicit in each behaviour.

b) Explain the link between the classification of learning out-
II comes on the basis of inherent intellectual complexity and the prevalent need to evaluate the educational progress of students on the basis of their evolution from concrete to abstract modes of reasoning.

c) Given a learning outcome, classify its operational behaviour
III in accordance with the level of intellectual sophistication required to ensure actual performance using Bloom's classification system.

Objective #5: To acquire the ability to use a table of specifications as a blueprint for selecting appropriate test items.

Learning Outcomes:

a) Explain the extent to which emphasis on the various areas of
II the cognitive domain should reflect the relative importance of these to the instructional objectives.

b) Identify one of the criteria for determining the relative value
II of each content area which shows the desired weight as a percentage.

c) Given a relevant set of data relating to a particular unit of
III learning susceptible to immediate evaluation, calculate the relative value of each of its content areas, using the criterion of your choice as an aid to the formulation of the "best" weights.

d) Identify the procdure for determining the relative value of
I each of the classifications of the cognitive domain resulting from the hierarchical ordering of the outcomes for a given unit of instruction.

e) Given a relevant set of data relating to a particular unit of
III learning susceptible to immediate evaluation, calculate the relative value of each of the classifications of the cognitive domain relating to the unit's learning outcomes in accordance with the procedure commonly used for obtaining such weights.

f) Write the formula for determining the number of items that
I should figure in each cell of a table of specifications.

g) Given a relevant situation in which the relative weight for
III each content area have been determined together with the value of each of the classifications of the cognitive domain and the total number of test items, calculate the number of items to be included in each cell of the table of specifications.

h) Construct a complete table of specifications from furnished
III or collected data.

Objective #6: To be able to determine the total number of items that may be reasonably included in a given test.

Learning Outcomes:

I a) Summarize the factors which often determine the limit on the total number of items comprising an achievement test.

I b) Identify the amount of time required on the average to answer (a) a true and false item, (b) a multiple-choice item, (c) a completion item and (d) a short essay type item for a given grade level and item difficulty.

III c) Given a time limit for administering a test, its appropriate item types and adequate information about the age and level of test sophistication of the students, calculate, as a function of these variables, the total number of test items possible, taking into account the time needed for distribution and collection of test materials and explanation of procedures.

Objective #7: To relate specific test and item characteristics to either criterion- or norm-referenced evaluation of student achievement.

Learning Outcomes:

I a) Describe the difference between norm-referenced and criterion-referenced tests.

I b) Describe the test and item characteristics most closely identified with a norm-referenced test.

I c) Describe the test and item characteristics most closely identified with a criterion referenced test.

Objective #8: To be able to formulate a set of test instructions as a means of enabling each student to understand in the most precise manner what is being asked of him/her either on the test itself or on a particular subset of items.

Learning Outcomes:

I a) Identify the three basic characteristics that an adequate set of test instructions should possess.

III b) Prepare a cover page of instructions for a supply-type test in the subject area of your choice for administration to senior secondary school students.

III c) Prepare a cover page of instructions for a recognition-type test in the subject area of your choice for administration to senior secondary school students.

Objective #9: To be able to arrange test items in an examination sheet in the context of total readability and item content.

Learning Outcomes:

I a) Describe the most convenient way of arranging the totality of a test's items in the examination paper, bearing in mind the content of each item.

I b) Describe the most convenient way of arranging the totality of a test's items in the examination paper, bearing in mind the different types of items which the test comprises.

III c) Bearing item content in mind, layout an examination paper from a given set of test items in the most economical and readable fashion.

Objective #10: To acquire a thorough knowledge of the test scoring techniques best suited for particular types of items and tests.

Learning Outcomes:

I a) Describe the advantages and disadvantages of the separate answer sheet as opposed to provisions for the recording of answers on the test paper itself.

I b) Identify the point at which the teacher should choose his correction and scoring procedures in the test planning stage.

II c) Explain the concept of "test sophistication" and relate it to the need for test scoring procedures that consider both the age level of students and the level of cognitive sophistication at which they operate.

III d) Construct overlay keys and strip scoring keys to fit tests comprising completion, multiple-choice, true and false or any combination of the above items.

Objective #11: To be able to construct and use supply- and recognition-type items in student achievement tests.

Learning Outcomes:

I a) Identify the different types of supply/recognition items.

I b) Describe the kinds of mental processes best measured by each of the following item types: essay, completion, multiple choice and true/false.

I c) Describe the Halo effect as it relates to essay-type questions.

I d) List some useful guidelines for the development of each of the following item types: essay, completion, multiple-choice and true/false.

I e) Describe at least two variations of each of the following item types: completion, multiple-choice and true/false.

I f) Describe the scoring economy associated with each of the following item types: essay, completion, multiple choice and true/false.

II g) Explain what is meant by informed judgement.

II h) Discuss the possible advantages of using supply versus recognition items in achievement tests purporting to measure higher order mental processes.

II i) Discuss the possible advantages of using supply versus recognition items in instruments purporting to measure knowledge and comprehension.

III j) Given a multiple choice item, identify its component parts namely the stem, the alternatives, the foils and the keyed response.

III k) Identify the component parts of a given completion item based on column association.

III l) Given a learning outcome, choose and construct the item type which best measures its behaviour.

Objective #12: To acquire the ability to plan, construct and criticize achievement tests purporting to measure student performance in a valid and reliable manner.

. . . . .

The foregoing list of objectives (minus the classification component) was provided to all treatment conditions in the present study in order to clarify the materials to be learned in the course of regular instruction. As a general statement of the objectives and learning outcomes proposed for the course of studies being undertaken in the context of the present experiment, the above list did not provide a rigorous behavioural description of the skills identified in each of the learning hierarchies comprising the units of instruction in the mastery and tests-only conditions. Although the behaviours it emphasizes as learning outcomes coicide with unit related goals in these conditions, the attainment of step-by-step mastery on the hierarchized sets of task elements required that such sub-levels of learning be also behaviourally defined as a means

of facilitating the attainment of the main unit goals. These lower level behavioural descriptions comprise a separate list of objectives which was not included in the present list.

APPENDIX C

Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #1

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by drawing comparisons between the traditional concept of classroom evaluation, and its likely effect on student self-concept, and current diagnostic and prescriptive techniques which emphasize formative rather than selective processes of measurement.	
Presentation	Lecture	
Discussion	Student discussion of the concepts relevant to the lectures. The instructor mediated in the discussion and checked for individual understanding of the relevant materials.	
In-Class Group Activities		Conveying the role of the feedback process in a normal learning/teaching situation from the cibernetic model of instruction presented in the lectures, using any one of the following pairs as model variables: (a) transmission and reception, (b) stimulus and response, (c) input and operation.
Suggested Activities for Students Exempt from Unit Tests and/or Learning Correctives	Library search of the literature relevant to an introductory course in measurement and evaluation and preparation of a list of suggested readings.	

Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #2

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by expounding the affective consequences of implementing an alternative to norm-referenced summative evaluation.	
Presentation	Lecture	
Discussion	Student discussion oriented towards the formulation of opinions regarding (a) the usefulness of formative evaluation procedures, (b) the importance of criterion-referenced instruments for evaluating hierarchies of learning and (c) the relevance of qualitative feedback devices in classroom settings of varying student aptitude.	
In-Class Group Activities		Weighing the merits of applying formative instruments to the subject area of the student's academic major and considering the possible effects that diagnostic/prescriptive procedures can have on student achievement, affect and self-concept. The role of formative evaluation as a qualitative measure of achievement had to be explained from the standpoint of the cibernetic model discussed in Unit #1.
Application		Demonstrating and justifying the proper use of formative evaluation procedures in a unit of instruction related to the subject area of the student's major.

Steps/Phase	Response-Guidance	Response-Practice
Suggested Activities for Students Exempt	An examination of the way in which the variables of the model of school learning (1963) can be manipulated such that achievement rather than learning time becomes the constant factor in instruction.	

Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #3

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by establishing a link between the formulation and classification of learning outcomes on the basis of inherent intellectual complexity and the prevalent need to evaluate the educational progress of students on the basis of their evoluation from concrete to abstract modes of reasoning.	
Presentation	Lecture	
Discussion	Student discussion centered around the advantages of formulating instructional objectives as a means of conveying precise behavioural descriptions of the subject matter pertaining to a given course of instruction.	
In-Class Group Activities		Analyzing instructional objectives in terms of their constituent elements and subsequently classifying their behaviour terms in accordance with the Bloom Taxonomy for the Cognitive Domain.
Application		Formulating and classifying a set of learning outcomes relevant to the subject area of each student's major.
Suggested Activities for Students Exempt from Unit Tests and/or Learning Correctives	Book report and analyses of selected chapters of Mager "Preparing Instructional Objectives" (1962).	

Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #4

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by discussing how subject content and classified learning outcomes can be brought together in order to provide a blueprint for the selection of appropriate test items. By establishing a relation between content and intellectual activity at the intersection of each content area with each cognitive classification, it becomes possible to calculate arithmetically the fraction of the total number of test items that should be attributed to each of the intersecting cells, with each of the items in the cell reflecting the relation between intellectual activity and content for the instructional objective(s) it is intended to measure. Given ongoing concerns about test item distribution, prospective teachers should readily identify with the need for constructing properly organized tables of specifications.	
Presentation	Lecture	
Discussion	Student discussion centered around the relationship between objectives, as statements of expected outcomes, and performance inherent levels of intellectual activity, and the best way of dealing with the measurement of such relationships in different testing situations was explored as a means of justifying the use of specific procedures for item selection.	
In-Class Group Activities		Arranging the content of Unit #2 into a two-way table of specifications showing, for each content area, the relative importance of its different levels of intellectual activity.

Steps/Phase	Response-Guidance	Response-Practice
Application		Attempting the different calculations involved in constructing a table of specifications from a sample of data supplied by the instructor.
Suggested Activities	Studying tables of specifications constructed for the selection of items comprising large, government type examinations.	

Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #5

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by showing how the grade obtained for a given test can be determined, to a large extent, by (a) test and item characteristics, (b) by the quality of the test instructions provided and (c) by the manner in which the instrument itself is laid out. As a possible means of developing interest in their use, subjects were informed of the existence of efficient correction and scoring procedures with particular emphasis being placed on the savings in teacher time and effort normally evolving from the application of these procedures.	
Presentation	Lecture	
Discussion	Student discussion emphasized the relevance of the test and item characteristics most often associated with each of the two main types of tests: norm-referenced and criterion-referenced tests. The layout of test papers according to item content and item type was equally discussed.	
In-Class Group Activities		Determining how different levels of test and cognitive sophistication exhibited by students might affect the construction of achievement tests. This group activity tied in with the necessity of formulating learning outcomes whose classifications translate into operational levels of intellectual activity which do not contradict age related levels of cognitive sophistication.

Steps/Phase	Response-Guidance	Response-Practice
Application		Laying out an examination paper in the most economic and readable fashion, bearing item content in mind.
Suggested Activities	Studying the different types of overlay and strip scoring keys.	

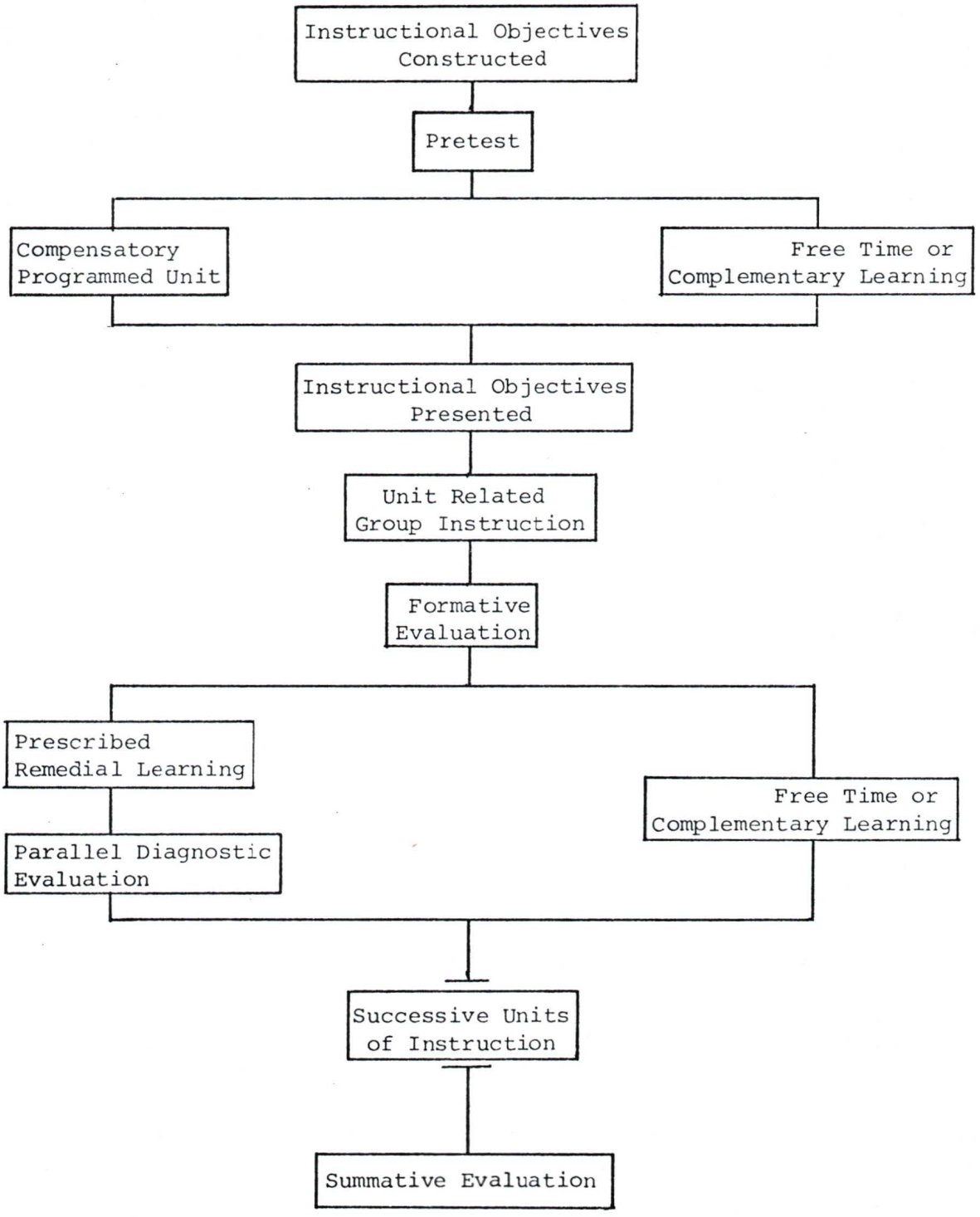
Learning/Teaching Strategy per Unit of Instruction or Chapter.

Unit #6

Steps/Phase	Response-Guidance	Response-Practice
Motivation	Arousal of interest and curiosity by hinting how item choice and use can influence the measurement of specific kinds of mental processes and determine correction and scoring procedures, either by adding to the burden of correction or by saving the teacher valuable time and effort.	
Presentation	Lecture	
Discussion	Discussion dealt mainly with the adverse affects of informed judgement and of the halo effect on the correction of certain supply type items.	
In-Class Group Activities		Listing and reflecting upon useful guidelines for the development of each of the item types studied, particular attention to be given to a survey of the efficacy of each item type for measuring specific kinds of mental processes.
Application		Constructing supply- and recognition-type items from a sample of course content previously translated into specific learning outcomes.
Suggested Activities for Students Exempt from Unit Tests and/or Learning Correctives	Probing the different variations of completion, multiple-choice, true and false and matching items followed by a critical evaluation of each variation in terms of prevailing strengths and weaknesses.	

APPENDIX D

Full Instructional Procedure for the Mastery Condition



APPENDIX E

Instructional Timetable

Month	Week of	Units
May	4 - 8	3 sessions: Unit #1
	11 - 15	3 sessions: Unit #1
	18 - 22	3 sessions: Unit #2
	25 - 29	3 sessions: Unit #3
June	1 - 5	3 sessions: Unit #3
		15 sessions: Total 1st Phase
	16 - 19	3 sessions: Unit #4
	22 - 26	3 sessions: Unit #4
July	30 - 3	3 sessions: Unit #5
	6 - 10	3 sessions: Unit #6
	13 - 17	3 sessions: Unit #6
		15 sessions: Total 2nd Phase

APPENDIX F

Description of Course Content
(Outline)

I. The Nature of Student Evaluation

1. How do measurement and evaluation procedures relate to the teaching/learning process: a cibernetic model.

2. The socio-cultural origins of achievement.

3. Evaluating student achievement from the standpoint of the social, intellectual, affective and psycho-motor variables which influence school related success.

II. A Specific Approach to the Evaluation of Student Achievement--Formative Evaluation

1. The concept of formative evaluation in the context of learning for mastery.

2. The role of formative evaluation in contemporary approaches to learning and instruction.

3. Conditions for the application of formative instruments.

4. Comparing formative and summative evaluation.

III. Planning Achievement Tests

1. Formulation and classification of behavioural objectives.

2. What should an achievement test purport to measure?

3. Table of specifications.

4. Test and item characteristics.

5. Determining the length of the instrument.

6. Writing precise and relevant test instruction.

7. Deciding on the test layout.

8. Scoring the test.

IV. Construction and Use of Supply-Type Tests

1. Essay tests.

2. Completion tests.

V. Construction and Use of Recognition-Type Tests

1. Multiple-choice tests.

2. True and false tests.

VI. Planning, Constructing and Criticizing an Achievement Test

1. Course project.

APPENDIX G

Units of Instruction Calculated on the Basis of Course Content for the Mastery and Tests-Only Conditions

1. Two periods of instruction, with a summative evaluation of achievement carried out at the completion of each period.

Instructional Objectives Covered	Engagement Time
1.1. During the first period of instruction: #1-4.	May 4 to June 5, 1981: 15 sessions of instruction.
1.2. During the second period of instruction: #5-11	June 16 to July 17, 1981: 15 sessions of instruction.

2. Six units of instruction, evaluated in terms of student achievement through at least one formative instrument per unit.

	Units Covered per Period of Instruction	Instructional Objectives Covered Per Unit of Instruction	Unit Engagement Time (Sessions of Instruction)
First period	Unit #1: The nature of student evaluation.	Objective #1.	Six class sessions
	Unit #2: Formative evaluation.	Objective #2.	Three class sessions
	Unit #3. Formulation and classification of objectives.	Objectives #3,4.	Six class sessions
Second period	Unit #4: Table of specifications/Total number of test items.	Objectives #5,6.	Six class sessions
	Unit #5: Criterion-/ norm-referenced tests; test instructions; test layout and scoring.	Objectives #7,8,9.	Three class sessions
	Unit #6: Construction and use of supply-type and recognition-type tests.	Objectives #10,11.	Six class sessions

APPENDIX H

Table of Specifications for the Dependent Measures

Summative Evaluation I

	weight	35%	30%	35%	
	intellectual activity level	I	II	III	
weight	content				items per area of content
40%	"a"	...	8	9	17
20%	"b"	6	5	6	17
40%	"c"	9	8	9	26
items per cognitive classification		15	21	24	60 No. of items in the pool

Summative Evaluation II

	weight	45%	20%	35%	
	intellectual activity level	I	II	III	
weight	content				items per area of content
40%	"a"	14	6	12	32
20%	"b"	7	3	6	16
40%	"c"	14	6	12	32
items per cognitive classification		35	15	30	80 No. of items in the pool

APPENDIX I

Item Details on the Affective Questionnaire

Items	Attitude Scale
1. Previous knowledge of course content.	- some knowledge - little knowledge - no previous knowledge
2. Knowledge of the existence of the course in the university curriculum.	
3. Relevance of the course as given for future secondary school teachers.	- most relevant - relevant - some relevance - little relevance - irrelevant
4. Course content up to expectation in terms of what could be expected from a course of this nature.	- yes - uncertain - no * if answering "no" or "uncertain" give details.
5. Applicability of subject matter of the course to a classroom situation of one's own, should one become a teacher.	- yes - uncertain - no - not applicable * if answering "no" or "uncertain" give details.
6. Course load.	- about right - too much - insufficient
7. Relevance of presenting course subject matter in a different way.	- yes - no * if answering "no" give details
8. Extent to which the present course fostered knowledge about specific classroom techniques aimed at establishing better learning for students as well as more accurate procedures for the evaluation of student achievement.	- substantial contribution - better-than-average contribution - some contribution - little contribution - no contribution

Items	Attitude Scale
9. Quality of the instruction offered by the course's instructor.	- excellent - good
10. Quality of the assistance provided by the instructor to students in and outside of the classroom.	- average - poor - extremely poor
11. Plan to become a teacher at the end of formal university training.	- yes - uncertain - no
12. Willingness to take another university course by the same method--with unit tests and instructional correctives (when applicable).	- yes - possibly - no * if answering "no" or "possibly" give details.
13. Perceived extent to which recourse to ungraded evaluation as well as supplementary learning correctives (when applicable) influenced individual course performance.	- substantial influence - considerable influence - some influence - little influence - no influence at all
14. Was subject's personal learning experience as derived from the way the present course was taught any greater than that derived from other courses in his/her curriculum in which instruction was based on the conventional method of lecture discussion.	- yes - uncertain - no * if answering "no" or "uncertain" give details.
15. Weekly time on task for the present course.	- one hour - two hours - three hours - four hours - five hours
16. Student perception of final summative grade for the course should learning have occurred in the traditional, lecture discussion way.	- final grade much lower with the lecture/ discussion method - final grade somewhat lower with lecture discussion method - no difference - final grade somewhat better with lecture discussion method - final grade much better with lecture discussion method
17. Observations	

VITA

Surname: Peixoto Given Names: Ermelindo Manuel Bernardo

Place of Birth: Pico, Azores Date of Birth: August 11, 1951

Educational Institutions Attended:

University of Victoria, Victoria 1970 to 1975

Degrees, Diplomas Awarded:

B.A. (Honours)	1974	University of Victoria, Victoria
Dip.Ed.	1975	University of Victoria, Victoria
Licenciate	1976	(Equip) Universidades Portuguesas

Honors and Awards:

Azores Government Grants, 1980/81 and 1981/82

PARTIAL COPYRIGHT LICENSE

I hereby grant the right to lend my thesis (the title of which is shown below) to users of the University of Victoria Library, and to make *single copies only* for such users or in response to a request from the library of any other university, or similar institution, on its behalf or for one of its users. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by me or a member of the University designated by me. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Title of Thesis:

THE EFFECTS OF MASTERY LEARNING ON THE TEST PERFORMANCE OF FIRST YEAR STUDENTS ENROLLED IN A MEASUREMENT AND EVALUATION COURSE AT THE UNIVERSITY OF THE AZORES

Author [redacted]

Signature

Ermelindo Manuel Peixoto

February 17, 1982