A SELF - INSTRUCTIONAL PACKAGE AS AN ALTERNATIVE
TO LECTURING IN A MEXICAN UNIVERSITY

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ABSTRACT

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The purpose of this study was to determine the effectiveness of a
self - instructional package for teaching the course in scientific
method to first year students at the University of Aguascalientes in
Mexico as compared to traditional classroom instruction in scientific
method.

The package included two units from the regular course in scientific
method. The medium was print and included words and diagrams presented in
a booklet.

Subjects for this study were 72 first year university students,
Spanish speaking, enrolled in the bachelor's programs in education and
public health at the University of Aguascalientes.

The research design was a two-way repeated measures design with
two treatment groups -- one receiving the self - instructional package
and one receiving classroom instruction -- and an immediate posttest
and a delayed posttest as the repeated factor.

Other variables investigated to determine their effect on the
dependent variables were: learning style preference; sex; age and time
spent working with the package. An analysis of covariance was performed

using the pretest scores as a covariate. The group using the package performed significantly better on the immediate posttest (p = .004) than the group under classroom instruction. No significant differences between groups were found on the delayed posttest. A significant two - way interaction (p = .001) was found between learning style preference and treatment; students with a high preference for working alone did best using the package and least well under classroom instruction, and students with a low preference for working alone did least well using the package and best under classroom instruction.

Time spent working on the package correlated significantly (r = .55, p = .005) with posttest scores.

Student evaluations of the self - instructional package were extremely favourable.

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Maria de la Luz Pasillas-Farfan

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

Introduction

Despite numerous scholarly studies that point out the need to design different teaching methods and instruments in a way that agrees with the learners' preferences and characteristics (Coop & Brown, 1970; Pask, 1976; Dunn & Dunn, 1978; Greco & McClung, 1979), the lecture method remains widely used as the principal instruction medium in many schools.

The lecture method is not always the most effective technique for transmitting information for all types of students (McLeish, 1968). According to Dunn and Dunn (1978), only between two to four students in each group of ten learn best by listening. However, it seems that the use of audiovisual materials to support the lecture enhances understanding and retention (Broadwell, 1980).

These findings suggest that students' learning improves when they use their different senses. While some students prefer to learn by reading, others prefer to learn by listening and observing.

Individual differences among learners are many and diverse; consequently, it becomes difficult for an educator to determine which types of media presentation to employ to certain group of learners, if he ignores the students' preferences and traits (Gagné & Briggs, 1974).

Generally, students are presented information about a subject matter by means of the traditional classroom lecture. Many students, however, strongly prefer another way of receiving instruction. This is especially so if the mode of instruction jibes with their personal

characteristics (Pask, 1976).

Thus, research - based findings so far emphasize the need for educators to devote a substantial portion of their planning to the "discovery" of the students' qualities and inclinations. Doing this would enable educators to use the most appropriate presentation techniques to bring about the greatest learning among their students.

A self instructional package is one such a teaching presentation which can help facilitate learning if the characteristics of the students are taken into account. This can be a teaching technique which gives a variety of student characteristics the recognition due them.

Statement of the Problem

The nine year old University of Aguascalientes in Mexico has 20 Bachelor Programs in diverse disciplines, and four technical programs. The university will be offering five other Bachelor's Programs next September (1982).

This year (1981), the total population in the university is 2,720 students enrolled in the Bachelor's Programs, and 407 enrolled in the technical programs. This means 3,127 university students all in all.

The University of Aguascalientes follows a "Development Plan" which makes projections related to and dictated by its growth and by its burgeoning student population. Its development programs focus on needed human resources and material resources as well..

The university follows an academic policy of requiring all new students in the Bachelor's Programs - regardless of the program they

are in -- to enroll in certain basic and compulsory courses. These courses include logic, mathematics, speed reading, methods of study and the course called scientific method. These courses are compulsory because it is believed that their content can provide the students with vital tools that will enable them to study more efficiently and to undertake more adequate research by knowing the necessary steps involved in any research process.

The freshmen population affected by this academic policy (i.e., enrolling in certain required courses) number about 886 students in 1981. This population increases every year since new programs are being implemented. If we divide these 886 students into groups of 30 students, we would have 29 groups, which would mean 29 professors for each compulsory course. This is a situation the university can ill afford.

In the University of Aguascalientes - as in any other university - it is imperative that the professors spend some of their time preparing for their classes, conducting research and advising the students. If the professors were to teach the same course in more than one class, they would spend a great deal of their time working in the classroom, repeating the same lecture and instructions over and over again.

This would be an ideal situation in which new teaching methods or new teaching instruments can be tried out, to determine if adopting them would lessen the teaching load teachers presently bear.

The Purpose of the Study

It is the intent of this study to determine whether a print self instructional package could both perform the role of a classroom teacher

and still present the material as effectively as, if not more so, than the traditional class lecture, according to the situation previously described at the University of Aguascalientes. Additionally, the study seeks to ascertain whether factors such as learning style preference, age, and sex of the students influence the outcomes of both modes of presenting information to the students.

Another purpose of this study is to motivate other teachers in the University of Aguascalientes to develop their own package, using the package in this study as a model, if it is shown to be effective.

Objectives of the Study

The objectives of this study are as follows:

1) To produce an appropriate print self-instructional package on the scientific method for first year students at the University of Aguascalientes in Mexico.

2) To analyze and evaluate the effectiveness and appeal package by applying it to a group of freshmen students, assisted by a tutor.

3) To analyze and compare the outcomes of the group studying with the package and an equivalent group receiving traditional class instruction.

4) To determine if factors such as learning style preference, age, and sex of the students affect the outcomes of the performance of either group.

5) To acquaint university authorities with the possible advantages and disadvantages of using this particular instrument to individualize learning.

CHAPTER II

Review of the Literature

Individualized Instruction

In the last 50 years advantages offered by individualized instruction have been widely discussed in studies, books, seminars and dissertations. Although the benefits that can be derived from individualized instruction have been outlined, many educators still follow the traditional mode of instruction, the lecture method.

Educators such as Bloom (1971), Gagné and Briggs (1974), Rowntree (1976) and Mitchell (1980) have recognized the need for individualization of instruction, some of them proposing concrete theories and effective instruments.

Individualized Instruction, according to Cooley and Glaser (1971) "... is essentially the adaptation of instructional practices to individual requirements. Three major factors are involved, each of which defines a set of variables in the system: i) educational goals; ii) individual capabilities and iii) instructional means" (p. 95).

This implies that in any educational situation, there are a great variety of possibilities such as the presence of different types of students with different capabilities, and the availability of many techniques that the educators must adopt according to educational goals and individual capabilities.

According to Wakarchuck (Note 1), individualized instruction need not be the same as teaching students individually since "... An

instructional system is individualized when the traits of each student play a major part in the selection of materials, procedures and time" (p.5).

Viewed under the light of our complex technological society, conventional educational ways become inadequate and obsolete. Educators must think in terms of providing appropriate instructional alternatives for the individual student (Bishop, 1971). The characteristics and points of view of a student are very different from those of his peers with whom he must share standard classroom teaching. His individual experiences can be better tapped and exploited if individualized teaching instruments' are used (Mitchell, 1980, p. 48).

Even though some teachers continue to employ the "chalk-talk" type of instruction as a main teaching technique, there have been several efforts to individualize instruction. Recently, instructional methods and organizational patterns in all educational levels, especially in elementary and secondary levels (Bishop, 1971) have reflected a strong desire to develop and implement more effective techniques according to the individual differences and individual needs of the students.

Individualization needs an organization that permits the students to enroll only in activities which are appropriate to their individual differences, and to their own style and rate of learning (Mitchell, 1980; Bishop, 1971; Greco and McClung, 1979; Coop and Brown, 1970).

Under this type of organization that emphasizes individual instruction, the students' independence is promoted; the students are given the chance to study beyond the regular curriculum they follow; and the maximum use of instructional resources is encouraged (Bishop, 1971).

Individualized Instruction and Learning Style

It is clear that a class is composed of groups of students that represent different backgrounds, capabilities, preferences and learning styles (Mitchell, 1980; Bishop, 1971; Pask, 1976, Dunn & Dunn, 1978). This consideration underlines the need for educators to individualize instruction so that instruction can be more realistic and capable of producing learning gains.

The call for increased research in topics related to the interaction between specific individual characteristics and instructional design elements continues (Allen, 1975; Clark, 1975; Pask, 1976; Dunn & Dunn, 1978). A major emphasis has been the importance of the design of instructional materials and techniques for specific learner groups (Greco and McClung, 1979).

Pask (1976) points out the importance of knowing students' learning style and their preference for a specific way of subject matter presentation, when he says: "... Normally students receive subject matter presented in only one particular way, yet they consistently prefer a particular type of learning strategy, when given a choice. If the teaching strategy is matched to the same type of learning style, the students will learn more quickly and retain the information for longer..." (p. 132).

Coop and Brown (1970) suggest that "... no one teaching method would be best for all students since students vary greatly in their cognitive functioning. Some teaching methods may favor one type of students while other teaching methods might facilitate the achievement of a different type of students" (p. 401).

Dunn and Dunn (1978) experimented on matching some special student qualities and preferences with certain teaching methods. Interestingly enough, they found that students with special characteristics prefer certain teaching methods in agreement with their learning styles. The next task is to try to construct new teaching techniques that reflect the characteristics of specific groups of learners.

Dunn and Dunn report research data that yield at least eighteen categories that, when bunched into groups suggest that learners are affected by four stimuli. An outcome of this classification is determining the students' qualities and considering a matching teaching instrument based on a diagnosis learning style (see figure 1).

Stimuli	Elements					
Environment	Sound	Light		Temperature		Design
Emotional	Motivation		Persistence	Responsi-bility		Structure
Sociological	Peers	Self	Pair	Team	Adult	Varied
Physical	Perceptual		Intake	Time	Mobility	

Figure 1. Stimuli and elements for a 'diagnosis learning style'

Adapted from: Teaching students through their individual learning styles. by Dunn, R. and Dunn, K. Reston Virginia: A Prentice - Hall Company, 1978 (p.4).

An explanation of how the stimuli and elements influence a student's learning preferences follows:

Sound — Some students can study with noise, others need silence while studying. This aspect is related to the time and place they prefer to study.

Light — Light is a factor that appears to affect fewer people than does sound. (However, it is important to consider this factor in the obtained results, because some students, for example, cannot read for long periods of time in the classroom or library. One reason is that artificial light is used in those places, and some students can read and see better using natural light. This is related to the place and time they prefer to study.

Temperature — Some students prefer working by themselves because they do not like to work in warm, crowded and small classrooms where they are uncomfortable. They prefer cool places to study.

Design — This aspect refers to the place of study, how formal or informal it is. Some students can study better in the library. Others can do it better while relaxing at home enjoying a cup of coffee.

Motivation — Some students need to be heavily motivated externally to learn, while others do not need much because they are internally motivated.

Persistence   - When given a task to complete, some students
               study hard and ask teachers and other students
               for help until they have finished their work.
               Others who have short attention spans, do not
               continue because they cannot work for long
               periods of time on anything.

Responsibility - Whether students are able to take responsibility
               for their work is a very important factor to
               consider regarding success in studying with a
               self-instructional package. Assuming respon-
               sibility is a characteristic which is easier to
               find more often in collegiate students.

Structure   - The preference for structure while studying
               depends a lot on the organization of knowledge
               in the minds of the students. Some of them
               like to go from simple to complex things. The
               amount and kind of study have to be related to
               the personal cognitive structure of the students.

Sociological Elements - Students can learn in a variety of social
               patterns. Each student has his preference that
               includes working alone, with one or two friends,
               with a small group or as a part of a team. It
               is important to identify how each student learns
               and try to assign their work according to their
               preference and style.

Physical Elements - Although students may learn best through different
               senses, some schools and universities continue to
               utilize lecture as a principal teaching method

when, according to Dunn and Dunn (1978), only
between two and four students in each group
of ten learn best by listening. Some students
prefer learning by reading and they could be
more effective learners studying through a
print self - instructional package.

Other students can learn best by listening and
watching at the same time. For them learning
could be easier through a sound slide presen-
tation or a television program. It is important
to know the student's preferences in order to
use the correct teaching method or the right
instrument according to the student's preferences
and strong points.

Intake

By intake, Dunn and Dunn mean the need, for some
students to eat something while they are studying.
This need can be important because students use
up energy which they need to recover while
studying. If these students were allowed to
eat something, the results could be better. If
the teacher is using lectures as the only teaching
method it is difficult for students to satisfy
this necessity. But, if they are studying on
their own at home, it could be certainly easier
for them.

Time

Some students can study better in the morning.
Other students can do it better in the afternoon,

perhaps after taking a nap, and others prefer to
do it at night when everything is silent. This
is another characteristic that could be
accommodated by using print packages. They
can be used anytime and anywhere.

Mobility — While attending a lecture in the classroom,
students have to be quiet and silent. Some
students like this. However, others need to
move (i.e., standing up, changing sitting
positions, etc.) very often. In this case they
need to learn using a different teaching
instrument.

Dunn and Dunn suggested some essential and some secondary
characteristics that students must possess in order to be successful
while studying, using print self-instructional materials.

The essential characteristics are:

- Internal motivation
- Persistence
- Responsibility
- Need for structure
- Need to work alone
- Visual orientation
- Preference for reading
- Positive attitude toward interacting with a tutor

The secondary characteristics are:

- Sound
- Light
- Temperature
- Design
- A need for intake
- Appropriate time of day
- Need for mobility

Students whose preferences correspond to the characteristics presented above will probably learn easier if they study with print self - instructional packages.

Self - Instructional Packages

According to Rowntree (1976), "... self instruction is a situation in which students are usually working as individuals, using a package of written or recorded or photographed learning materials. In the self - instruction situation students receive little or no direct face - to face tuition." (p. 12).

A self - instructional package can be viewed as falling under the category of 'Distance Study' which Moore (1975) defined as, "... learning supported by those teaching methods in which because of the physical separateness of learners and teachers, the interactive, as well as the preactive phase of teaching, is conducted through print, mechanical, or electronic devices" (p. 5).

It can also be classified as a form of 'Distance Education' which "... covers the various forms of study at all levels which are not under the continuous, immediate supervision of tutors present with their students in lecture rooms or on the same premises, but which nevertheless, benefit from the planning, guidance and tuition of a tutorial organisation" (Holmberg, 1977).

Within the scope of 'Distance Education' or 'Distance Study' can be found the following:

Computer assisted instruction (CAI); Educational Television (ETV) teaching machines; sound - slide presentations; modules; learning packages and programmed learning, among others.

The earlier views on the outstanding features of a self -
instructional package, then point out that a self - instructional
package is a collection of materials organized in a manner which permits
the students to learn by themselves, with the minimum participation, or
total absence of the teacher (Wilkinson, 1979).

Talbert (1968) emphasized the role of the student in the learning
packages when he said "... the learning package is student oriented.
It tells the student what he is going to do. The package puts the
responsibility for learning where it belongs: on the student" (p. 21).

Learning packages are designed to operate with a minimum of
teaching contact but retaining optimum learning efficiency (Wilkinson,
1976).

Learning packages can include many types of materials presented
by itself as one material or in combination with other materials to
facilitate learning among the students. These materials could be:

a) Materials to be read (instructions, information, etc.)

b) Materials to be listened to (audio tape, records, etc.)

c) Materials to be looked at (pictures, slides, diagrams, graphs, etc.)

d) Materials to be looked at and listened to (television program,
    sound-slide, etc.)

e) Materials to work with (models, computer program, apparatus, etc.)

The selection of one of these materials alone or in combination
with others depends on the objectives of the package and the emphasis
that the teacher puts in the package (Wilkinson, 1976; Manwaring, 1976).
Dunn and Dunn (1978) pointed out some advantages of the use of instructional
packages for different types of learners:

> Because students work independently (or with a friend)
> and the materials are self-corrective, the packages can
> meet the needs of learners on several academic levels -
> youngsters with learning disabilities who require special
> attention; slow learners who need more time to grasp
> new material; average youngsters who prefer working on
> their own or for shorter or longer blocks of time;
> advanced students who are capable of progressing faster
> than their peers; and any interested student who wants
> to learn about a topic, concept, or skill at the moment
> when he or she desires, not when the teacher is able to
> get to the subject. Packages don't take up much class-
> room space, and they are particularly well suited to
> home study (pp. 256-257).

According to Wilkinson (1976), learning packages present some

advantages which could help offer possible solutions to the problems

usually encountered in higher education. These advantages include the

following:

1. They increase the availability of courses despite problems of small
   numbers, accommodation, timetabling and shortage of skilled lectures.

2. They provide opportunities for 'learning from a distance'.

3. They provide opportunity for educational expansion despite financial
   stricture.

4. They allow options to be offered to meet a wider range of interests.

5. They can offer a greater variety of learning experiences, thus
   allowing selection according to individual styles of learning.

6. They allow students to learn at their own pace and in their own time.
   (p. 312).

A familiar situation that occurs in many educational institutions

in Mexico and in other parts of the world is that modern teaching aids

(e.g., computers, television, etc.) are expensive, and hence, cannot be

acquired easily by many schools. This is further complicated by a

growing student population that outnumbers the teachers. Thus schools

rely heavily on the print self - instructional packages, which in this

situation, appears to have great potential.

Print self - instructional packages have several advantages as

a medium of instruction which include:

- The material to be learned is more readily available in the self - instructional package than in the lecture method of instruction. The student can use the package without having to attend the class according to his preference. It is especially useful for students who have to absent themselves from school for some reason. (Manwaring 1976; Wilkinson, 1979).

- No-special equipment is required. It can be used anytime and anywhere. Students can bring the package to the library, to their homes or to any place they want to study (Manwaning, 1976; Moore et al., 1977-78).

- Students can work on the content of the package intensively or slowly, depending on their style and capabilities. This is because the material is presented in short units which students can cover according to their necessities (Rowntree, 1976; Manwaring, 1976).

- The material presented in the package allows the students to return to it as many times as necessary.

- The material presented in the package also gives the students feedback allowing them to judge their own performance. This helps the student to establish an active interaction with the package. This interaction motivates students to pursue further study. (Manwaring, 1976).

- Working by themselves enables students to assume more responsibility for their learning activities.

- The package usually provides effective and attractive instruction for diverse types of students (Cowan, 1976).

- The package can help bring about a high level of mastery of the subject matter, while presenting the materials to be learned in

an attractive way (Cheung, Note 2).

There are also some advantages for teachers who use learning packages as medium of instruction. It does not follow that a teacher who is going to work with a group using a self - instructional package will be relieved of his regular work once he distributes the materials to the students. Possibly he will have more work, but this will permit him to engage in more varied and creative enterprises instead of spending all his time teaching the same things over and over in the classroom. It is productively and economically advantaqeous.

Farley and Moore (1975) suggest some tasks that teachers can engage in while working with a self - instructional package to guide the students, and at the same time while exercising some other productive functions. The tasks include:

- Evaluating and editing packages.
- Developing new packaqes.
- Working with teaching teams.
- Planning lectures, demonstrations, discussions.
- Searching for and acquiring additional resources.
- Keeping a record of students' performance.
- Participating in other academic activities in the institution.
- Working with other personnel, administrators, etc.
- Individualizing instruction.

Open University Recommendations for Constructing Print Self-Instructional Packages

Rowntree (1976) -- in an open University self - instructional guide to the use of self - insturctional materials -- points out that print self - instructional packages must contain four fundamental aspects, the inclusion of which ensures that the advantages mentioned earlier can be present in an individualized learning situation. These aspects follow:

Selection   - This refers to the selection of the necessary materials the students will work with, to achieve the objectives.

Structure   - The selected materials should be assembled in some instructional way to facilitate learning, keeping in mind that if guided, students will learn by themselves.

Supervision   - This refers to the need for the teacher to keep track of the students' progress. Supervision can be done either face to face (i.e., between tutor and students) or through exercises or questions that students are asked to answer in written exercises. Rowntree, calls this scheme 'tutorial - in - print'.

Support   - After reviewing the selection, the structure and the supervision (that were discussed earlier), the teacher decides if additional materials are still needed that supplement the content of the self - instructional materials.

According to Rowntree (1976) preparation of a print self - instructional package entails several steps:

1) Once the students who will work with the package have been selected, clearly specify the characteristics of this target audience. The students' age, sex and background must likwise be defined. It should also be clarified if the students' involvement in the self - instructional activity will be compulsory or optional.

2) Locate the sources of information on the topic of the lesson. Once the topic is delineated, the next step is to look for sources of information about the topic. It can be done through:

- a subject matter expert's assistance
- books

- articles in journals
- newspapers and pertinent publications

3) Review the 'literature' on the subject.

This task is an important phase in the production of a valuable and reliable package.

4) Establish the general aims of the lesson.

By 'aims' is meant a short statement of why this particular material will be taught and what, in very general terms, the teacher hopes to achieve in the end.

5) Identify the constraints.

A constraint is any factor which might interfere with or limit the achievement of a goal (i.e., time available, funds at the teacher's disposal, material and human resources, etc.).

6) Choose the specific content of the package.

Following the review of 'literature' on the topic, and after establishing the general aims, the next task is selecting the content of the package.

7) Prepare a set of objectives for the lesson discussed in the package. After finally choosing the content the designer should decide what the students will do with the content of the package. The specific learning objectives defined in terms of behaviors the students will be expected to perform, should be included at the beginning of the package.

8) Deciding on the order of presentation.

It is important to establish an order of presentation which the teacher preparing the materials can follow while setting up the order, the characteristics of the students, the nature of the content of the package and the objectives should also be borne in mind. Toward

this end, some recommended techniques are: concept map, looking
for hierarchies, or constructing a 'flow diagram'.

9) Estimate students' workload.

Following the construction of a diagram to illustrate the order of
presentation, the next step is to approximate the length of time it
will take the students to study the material. Rowntree (1976)
puts forward some recommendations that would facilitate this task.
One is to consider the approximate number of words (by calculating
360 words for typed page) contained in the package and determine
the difficulty level of the materials.

Need for Tutoring While Using Self - Instructional Materials

Despite all the advantages and recommendations presented earlier,
Wilkinson (1979) in a study involving students learning with these
materials suggested that working with a self - instructional package
can sometimes becom boring and taxing. This is more so the case when
motivation and self-discipline are low.

The reason for this problem is that all self - instructional
materials have some imperfections. (Wilkinson, 1979). This is the
fundamental reason for the presence of a tutor who can help solve possible
problems that may emerge.

In the Wilkinson (1979) study, students were asked to work on
a self - instructional package where a questionnaire was administered
to determine students' attitutde toward the materials. Fifty-six percent
of the students thought the materials were sometimes boring; thirty percent
thought the materials were dehumanizing; sixty-seven percent did not

always understand the materials; and forty-two percent felt they did not have enough confidence to work with the materials alone.

While using the materials, sixty-eight percent felt they would have welcomed opportunities to discuss some points with another person.

Romiszowski (1978) found no difference between the results achieved by groups studying with a self - instructional text on their own without any tutorial assistance, and groups receiving normal class-room based group instruction. However he found differences in the same comparison while utilizing tutorial assistance in the self - instructional part.

· Wilkinson (1976) believes that the presence of tutor/learner contact is a necessary factor in any learning situation.

The interaction between tutor and student helps bring about communication. On the one hand, the tutor wants the student to put to good use the ideas discussed in the package, while the student, on the other hand, appreciates getting feedback from the tutor -- about what he has done.

According to Rowntree (1976) "... it is an article of faith among educators (with considerable backing from research findings) that such learning-- active learning with feedback -- is both more interesting and more durable than just listening (or just reading)". (pp. 152-153).

Thus, if a self - instructional package is to be developed, it will probably be most effective when used in conjunction with a tutor or a tutorial assistance.

CHAPTER III

Method

Subjects

Population: The population for this study was made up of 886 freshmen enrolled in any Bachelor's program in the University of Aguascalientes in Mexico.

These freshmen were male and female, Spanish - speaking, and generally between 17 to 25 years of age except for three students who were over 30 years of age.

Sample: From the entire freshmen population, 72 students were chosen as subjects in this study.

The 72 subjects were assigned to two different groups:

1) The experimental group
2) The control group

The experimental group consisted of freshmen enrolled in the Bachelor's program in Education during the first semester of 1981. The first-year students numbered 48 in all, male and female, 17 to 39 years of age and Spanish speaking.

The control group in this study was made up of 24 students enrolled in the Bachelor's program in Public Health during the first semester of 1981. They were male and female, aged between 17 to 31, and Spanish speaking.

Both groups used in this study were similar in the sense that:

1) both were composed of students enrolled in Bachelor's programs during the same semester; 2) they were similar in age; 3) both sexes were represented in the two groups; 4) it was expected that both groups had the same level of academic preparation. Although they come from different high schools, they were all in their first year at the university; 5) they come from similar socio-economic background.

The two groups were randomly chosen from among 30 groups of first year students enrolled in several Bachelor's programs offered by the University of Acuascalientes. The two intact classes were randomly assigned to one or the other treatment group.

Research Design

The experimental design of this study can be diagrammatically represented as follows:

	Pretest	Treatment	Immediate Posttest	Delayed Posttest
Package n=48	O_1	X_1	O_3	O_5
Class n=24	O_2	X_2	O_4	O_6

Where:

X_1 = treatment 1 - Individualized package
X_2 = treatment 2 - Traditional classroom instruction
O_1 = observation 1 - Pretest package group
O_2 = observation 2 - Pretest classroom group
O_3 = observation 3 - Immediate posttest package group
O_4 = observation 4 - Immediate posttest classroom group
O_5 = observation 5 - Delayed posttest package group
O_6 = observation 6 - Delayed posttest classroom group

------- Intact classes were assigned to the treatments. However, the two groups included in the study were randomly selected from 30 groups.

The following comparisons were undertaken using the analysis of covariance:

O_3 vs. O_4 using pretest scores (O_1 and O_2) as a covariate.

O_5 vs. O_6 using pretest scores (O_1 and O_2) as a covariate.

The following comparisons were undertaken using the paired t - test for dependent samples.

O_3 vs. O_5

O_4 vs. O_6

Operational Definition of Variables

The variables used in this study follow:

Independent   Method of instruction: a print self - instructional package vs. traditional teaching

These two methods of instruction will be compared to find out which produces better results.

Dependent   Performance on posttest and delayed posttest.

The posttest will help determine if the objectives of each method of instruction are realized. The delayed posttest will help determine the extent to which the students retain the information acquired after a two week delay of time.

Moderator   Sex

Some groups in the University of Aguascalientes are predominantly made up of male or female

students. For example, the agronomy program is all male, while the nursing program is all female. Thus, if sex affects the outcomes, this would enable administrators to prescribe the package for the group that best responded to it.

Age

Another potential moderating variable that might differentially affect results is age. Older students would probably be more respon- sible and study by themselves, while younger students would probably prefer the traditional class lectures. The study will try to ascertain whether age interacts with the different methods of instruction.

Learning Style

The results of many studies (Coop & Brown, 1970; Pask, 1976; Dunn & Dunn, 1978; Greco & McClung, 1979) suggest that if the learning style preferences of the students are matched with a teaching method according to students' characteristics, performance will improve. Learning style preference will be measured by the learning style questionnaire developed especially for this purpose using variables identified through the literature review.

The effect of learning style preferences on performance under each method of instruction

will be examined. If any effects are found, it would be possible to administer the learning style questionnaire to prospective students and steer them toward individualized or classroom instruction depending on their responses to the questionnaire.

Time spent working with the package

One of the advantages of self - instructional packages is that students can work at their own pace (Manwaring, 1976; Wilkinson, 1976).

If students spend more time working with the package, it is probably because they need more time. And if they spend less time with the package, it may be because they need less time to complete the learning activity.

This study will likewise seek to find out if time spent working with the package affects the outcomes.

Hypotheses

H_1 The individualized group (i.e., students using the package) will score higher on the posttest than the classroom group (i.e., students receiving traditional classroom instruction).

The result stated above is expected because individualized instruction has been shown to be effective. It permits students to take part in activities which are appropriate to their individual differences, and to their own style and rate of learning (Coop & Brown, 1970; Bishop, 1971; Greco & McClung, 1979; Mitchell, 1980).

The lecture method meanwhile, has been found to be ineffective in transmitting information (McLeish, 1968). Since students using the package will learn by themselves while spending with the package only the time that they need, it is expected that the results will turn out to be better. Pretest scores and age will be used as covariates if found to be significantly related to posttest scores, in order to equalize the groups for their initial background knowledge of scientific method.

H_2 Students using the package will score higher in the delayed posttest than students receiving traditional teaching.

The materials contained in the package used in this study are organized with the end in view of producing better learning for a longer period of time.

It is expected that students using the package will store the information longer and recall it better than students receiving traditional teaching.

Pretest scores and age will be used as covariates, if found to be significantly related to posttest scores, in order to equalize the groups for their initial background knowledge of scientific method.

H_3 Moderator variables such as learning style, age and sex of the students will affect the scores differentially in the two treatment groups.

It is expected that learning style of the students will affect the scores differentially in the two treatment groups. This is because it has been suggested in many studies that students learn in a variety of ways which make them prefer certain teaching

methods (Coop & Brown, 1970; Pask, 1976; Dunn & Dunn, 1978; Greco & McClung, 1979).

This researcher is interested to determine if factors such as age and sex affect scores in the posttest by comparing the outcomes in the two treatment groups.

H_4 There will be a significant positive relationship between time spent working on the package and scores on the posttests.

One of the advantages of individualized instruction is that students can set aside only the time that they really need to work on the materials.

If motivated, students would likely spend more time and reread the materials until they feel that they   fully understand the materials read.

In general it is expected that, students who spend more time on the package will score better in both posttests.

Materials

To obtain the data for this study, the following materials were used:

Package: A 91 page print self - instructional package which contained words and diagrams -- was planned, developed, implemented and evaluated in this study. The topic discussed was scientific method. The contents of this package were based on the program of the regular course in scientific method which is taught to students who are in their first year at the University of Aguascalientes in Mexico.

The format followed in the preparation and development of the package was taken from an Open University packaged course intended for

teachers in higher education who wish to produce self - instructional

materials for their students (Rowntree, 1976).

The Open University format on organizational style recommended

by Rowntree (1976) was followed in the preparation of the self -

instructional materials.

The print self - instructional package contained the following

integrative parts:

1) <u>Objectives</u> - The objectives are the ends that the students are expected to achieve after reading the self - instructional package. The objectives are closely related to the content of the package and they indicate the kind of change (behavior) the students must achieve at the end of the learning experience (Bloom, 1974; Mager, 1975)

(See appendix A).

2) <u>Study Guide</u> - The package includes a study guide, which explains to the students the use of the material. More specifically, it concerns the following:

- How to work with the package to obtain the best results.

- How to read the information more effectively.

- How to answer the questions in the exercises and how to compare the learner's answers with the correct answers which are included as feedback after each question.

(See appendix A).

3) <u>Flow chart summary of the lesson</u> - This part is a graphic

representation of the steps to follow while working
on the package. The purpose of this flow chart was
to give the students a visual representation of the
steps to follow in order to complete the self-
instructional package (Popham and Baker, 1970)
(See appendix A).

4) <u>General Introduction</u> - The general introduction is an overview of
the role of science and technology in society and
man's role in the growth and development of science
and technology. The main purpose of this section
was to present the subject matter of the package and
to make the students mentally receptive to the
information contained in the lesson.

5) <u>Two sections of study</u> - The first section was about a) science and
common sense. b) technology, and c) the divisions
of science, namely formal, factual, social and
natural sciences, among others.

The second section was about scientific research;
the scientific method, and the steps involved in
the scientific method.

Each section contained the following: -

a) <u>An introduction to the specific topic of the section.</u>

This introduction was designed to make the student receptive to
the specific knowledge discussed, so that they would be able to assimilate
it easily.

b) <u>Information about the content of the section.</u>

This was the most important part in the package because it contained

the knowledge necessary for the achievement of the objective.

The information was presented to the students in short paragraphs following Rowntree's (1976) suggestions. In addition some suggestions forwarded by Gagné (1977), Popham and Baker (1970), Drumheller (1971) and Kemp (1980), on presentation of knowledge via individualized learning were followed. These suggestions included:

- Going from the simple to the complex

- Repetition to move concepts from short term memory to long term memory

- The formation of a chain with other knowledge the students acquired earlier.

- The use of attractive and encouraging formats for the students.

- Presentation of alternative ways of accomplishing objectives.

- Permitting students to practice with the material to bring about better understanding.

- Giving the students the responsibility of determining their study rate.

c) Examples related to the theme.

The purpose of the examples included in the package was to help the students understand the concepts presented by citing specific examples to reinforce the knowledge.

e.g.

Technology is the application of science. Technology is used mainly to improve the conditions of human life through the development of materials, equipment and processes that serve specific purposes.

Champagne, Klopfer and Anderson (1979) said that science describes the world as it really is, while technology reconstructs the world to serve human necessities.

An example of science is:

| A description or explanation of a natural phenomenon |

An example of technology is:

| The invention of a more efficient car or a more effective medicine to cure cancer. |

Package p. 17

d) Two exercises.

Each one made up of 9 or 10 questions related to the information. These exercises were intended to enable the students to work and practice with the learning materials. This is one of the necessary conditions to improve learning. (Rowntree, 1976; Gagné, 1977; Kemp, 1980).

Some of the questions required a single - word answer while others presented problem solving that required elaborate answers.

e) Feedback for each of the questions.

Feedback is an important factor in the design of the self - instructional package because it allows the student to know if his answer was correct. In effect, it may act as a positive reinforcer. (Mitchell, 1980; Manwaring, 1976). If the student's answer is not correct, the feedback provides the correct answer, thus helping the student realize what further information is necessary to improve his grasp of the concepts.

An example follows:

Question - Is Mathematics a factual science?

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Feedback

Mathematics is not a factual science. It is a formal science.

Remember that formal sciences are rational, systematic and verifiable, but they are not objective. They do not give us any information about reality. They are abstract and deal with ideal entities which exist only in the human mind.

Mathematics and Logic are examples of formal sciences.

Examples of factual sciences are: Biology, Chemistry and Physics (Package, p. 28).

f) Summary of the specific topic reviewed in each section.

The summary is an essential component of individualized learning materials because it covers the main points discussed in the different sections of the package. This is related to the factor repetition mentioned earlier (Gagné, 1977; Kemp, 1980) which is an important aspect to consider in the learning process. This is especially the case with self - instructional materials.

g) Supplementary materials.

In addition to the package, the students were provided with some articles and additional reading assignments. This was considered important since the strategy is meant to give the students a wider perspective of the topic.

The chapters and articles are as follows:

-- Bunge, Mario. Qué es la Ciencia? In La Ciencia su Método y su Filosofía. Buenos Aires: Ediciones Siglo xx, 1979. pp. 9 - 36

- Nagel, Ernest. La Ciencia y el sentido común. In La Estructura de la Ciencia. Buenos Aires: Editorial Paidos, 1974 pp. 57 - 62.

- Eastmond, Amarela. Niños aguzados y genios. In Naturaleza volumen
  12, numero 1 (83) febrero de 1981, pp. 16 - 18
- Hempel, Carl G. La Investigación Científica: Invención y Contrastación.
  In Filosofía de las Ciencias Naturales. Buenos Aires: Editorial
  Paidos, 1970. pp. 3 - 32.

Instructions for the students to read these supplementary materials were explicitly given in certain parts of the package which were related to the knowledge acquired in the package. The purpose of this supplementary material was to provide the students with additional information on the topic discussed in the package.

Instruments

Test   A 5 page pretest was prepared and later administered to measure the knowledge of the students before studying the package. Its purpose was to approximate the level of prior knowledge they had on the topic before the treatment to determine the actual knowledge they can acquire after studying the package.

The pretest consists of 2 multiple choice items as well as 6 true - false (this involved a special format in which false statements were corrected by replacing words) (See appendix B), 10 matching columns, 6 short - answer items and 2 open - ended questions (See appendix B).

The same test was given following the treatments as an immediate posttest and again after a delay of two weeks as a delayed posttest.

Learning style questionnaire.   A 5 page questionnaire was constructed

to identify the students' learning style. Learning style refers to the learners' preferences and needs while they are studying.

The learning style questionnaire was developed based on the essential and secondary characteristics identified by Dunn and Dunn (1978) as being necessary for students who study with print self – instructional materials and tutors if they are to be successful.

The essential characteristics are:

- Internal motivation
- Persistence
- Responsibility
- Need for structure
- Need to work alone
- Visual orientation
- Preference for reading
- Positive attitude toward interacting with a tutor

The secondary characteristics (characteristics to which print self – instructional materials can be accommodated) are:

- Sound
- Light
- Temperature
- Design
- A need for intake
- Approximate time of day
- Need for mobility

The questionnaire administered in this study to find out the students' learning style and preferences was based on all of the above characteristics identified by Dunn and Dunn (1978). This questionnaire is made up of multiple – choice items, and it was tried out on a pilot group of 20 students prior to its application in this study. Some revisions and additions were made following the suggestions and recommendations of these 20 students in order to improve it before it was used in this study (see Appendix C).

Evaluation form. A 2 page rating scale was also prepared to measure the students' attitude toward different components of the package such as objectives, content, organization, presentation, motivation, instructions, vocabulary, exercises and supplementary materials. It was prepared as a 5 point scale where 1 was the rating given to a feature that was considered least positive and 5 was the rating given if the feature was felt to be most positive (See appendix D).

Formative Evaluation

Formative evaluation was undertaken once the materials were completed. The purpose of this stage was to improve upon the instructional materials by presenting them to an equivalent group of students (i.e., students with the same qualities and studying under conditions similar to the subjects of this study). (Popham, 1973; Baker & Alkin, 1973).

The package was presented to three undergraduate, Spanish - speaking, students studying in Montreal. The pretest and posttest were also administered to these three students. They called this researcher's attention to the following weaknesses:

- Some words were difficult to understand
- Some examples were not clear enough
- Some instructions were difficult to follow
- Too little information about some topics
- Some questions were very difficult to answer
- Some questions were too easy, and hence, had to be changed

Following their suggestions, changes and adjustments were made in the package itself as well as in the pretest and posttest.

Three University of Aguascalientes professors (subject matter experts) also reviewed the package and found that it met with their approval.

Procedure

As previously stated, a pretest and a questionnaire were administered initially to determine previous knowledge about the topic and students' learning style, before distributing the package to the individualized group and before instruction for the classroom group was commenced. A posttest and delayed posttest (identical to the pretest) were administered to both groups after they studied the package and after receiving instruction on the Scientific Method in class.

This process was followed according to the schedule approved by the authorities at the University of Aguascalientes.

The entire experiment took place from September 7 up to September 29, 1981. The delayed posttest was administered 2 weeks later (October 13th, 1981). In the first week of September, the materials were readied for distribution to the students, and the two classes were randomly chosen from the population of first-year classes in scientific method.

On September 7th, the pretest and Learning Style questionnaire were administered to the individualized group and the classroom group.

The self - instructional package was distributed to the individualized group the following day. The students in this group were told that they should be able to complete the package in about 20 hours. They were also informed that they could organize their time any way they wish provided that they finished studying the package after 3 weeks. The schedule was set up this way for the university's convenience to correspond to the students' workload of 4 hours a week for a class and additional time outside. It is important to mention that the students were enrolled in another courses at the same time.

The classes for the classroom group started the same day under the instruction of this researcher, who is the author of the package as well.

The individualized group -- while studying the package -- could ask for advice as many times as they had to. The researcher gave advice to the students and encouraged them to do a good job during the 3 - week session.

It is important to mention that the mark obtained in the immediate posttest was taken as one third of the regular course in scientific method. This was planned with the end in view of further motivating the students to study the package.

This study was planned to incorporate the presence of a tutor as an important factor in this type of self - instructional experience. The presence of a tutor -- motivating, advising and encouraging the students (individually) to work at their best --was considered to be especially important because the subjects in this study were in their first year at the university and hence, not accustomed to working by themselves. It was thought that it would be important for the students to know that a tutor was available for anything they might want to ask regarding the self - instructional package.

Since this study was planned as just described, the fact that nobody asked for advice during the first 6 days made it desirable for the researcher to think of something that could help the adviser know about the progress of the students on a regular basis, as well as the problems they encountered while working on the materials.

A graph was created which was used to motivate the students, while enabling the adviser to keep track of the students' progress.

The graph made and used to record students' progress is illustrated
in Figure 2.

Figure 2. Example of the graph used in the study
to keep track of the students' progress.

The graph was made of cardboard, 55 by 35 centimeters in size.
It was placed in a strategic place in the home room of the individualized
group. The researcher always kept a copy of the progress graph to guard
against possible student tampering of the one in the classroom.

The students were asked to go twice a week to mark how far they
have gone in the graph and to talk with the adviser about their accomplish-
ment in studying the package.

The graph was very helpful in motivating the students to work with
the package. By looking at how their classmates were faring, the subjects
realized whether they should go faster or not. Using the graph was very

motivating, according to the students who were interviewed following their completion of their learning activity.

However, the students did not ask for help as often as it was expected. Out of 48 students in the individualized group:

1 student sought this researcher's assistance 4 times.

4 students sought this researcher's assistance 3 times.

8 students sought this researcher's assistance 2 times.

8 students sought this researcher's assistance 1 time.

27 students, did not solicit any help.

A day before the posttest was administered, the adviser had an individual interview with each one of the students belonging to the individualized group. Some of the topics covered in the interview included;

- The number of hours they spent working on the materials
- What their feelings were toward the package
- Whether or not they liked to work with this instrument
- If they worked on the materials at their best
- Why they did not ask for help (this applied particularly to the 27 students who never asked for help)

All of them answered this last question saying that they did not ask for help because the package was very clear, and the contents were very well explained. They also said that the steps to follow while working on the materials and the supplementary materials were likewise clear.

The classroom group held their class regularly, 4 hours a week. The content taught during the classes was exactly the same as that which the package contained. This researcher served as adviser of the students in the individualized group and classroom teacher. The class was presented in the form of lectures using the blackboard and some of the articles given in the package as supplementary materials as the only teaching aids.

A posttest was administered to the students of both groups the same day separately, in their regular class schedule.

The rating scale to evaluate the package was given to the students right after they finished answering the posttest.

The delayed posttest was administered to them 2 weeks later in the same manner as the posttest.

CHAPTER IV

Results

Analysis

Means and standard deviations for data in both treatments (students receiving the package and students receiving traditional class-room instruction) were calculated, including data yielded by the immediate and delayed posttests. Data were then submitted to an analysis of covariance using the pretest scores as a covariate. To ensure that the assumptions of the analysis of covariance were met, the homogeneity of variance between the two treatment groups on both the immediate and delayed posttest was tested. This was important to examine because the two treatment groups were of unequal size (n=24 and n=48).

In addition, multiple regression between the pretest and posttest measures were run separately for each treatment group to determine whether the slopes were homogeneous, further justifying the use of analysis of covariance.

The dependent t-test between pretest and immediate posttest scores was performed separately for each treatment group to determine whether the treatments significantly increased learning, as measured by the change in test scores.

The dependent t-test between immediate and delayed posttest scores was performed separately for each treatment group. The results of the t-tests indicate whether there were significant differences in posttest

scores over time.

In addition, secondary hypotheses about the effect of moderator variables such as age, sex and learning style preference on the treatments were investigated by calculating and comparing the correlation coefficients between the moderator variables and the posttest scores for each treatment group. A second method of investigating the relationship between the moderator variables and the effects of the treatment was to use a separate 2 - way analysis of covariance for each moderator variable (again using the pretest scores as a covariate) and examining the 2.- way interaction between the moderator variable and the treatment variable. These hypotheses involving the moderator variables were analysed separately for the immediate posttest and the delayed posttest.

The means of the treatment groups at each level of the moderator variable are presented for the moderator variables: age, sex, and learning style preference.

The correlation coefficients between time spent working with the package and the scores in the immediate posttest and the delayed posttest were computed for the group receiving the package. The significance of each correlation coefficient was ascertained.

The coefficient alpha reliability and test retest reliability were estimated to evaluate the posttest used in this study. Likewise, item discrimination and item difficulty indices were calculated for each item in the posttest.

Means and standard deviations of the rating scale used to evaluate the package were also calculated and presented.

Hypotheses One and Two

The first hypothesis-that students using the individualized package would score higher on the immediate posttest than students receiving traditional classroom instruction when pretest scores were taken into account - was confirmed.

The second hypothesis - that students using the individualized package would score higher on the delayed posttest than students receiving traditional classroom instruction when pretest scores were taken into account - was not confirmed.

An analysis of covariance was run using pretest scores as a covariate. The assumption of homogeneity of variance between the two treatment groups was met for both the immediate posttest ($F=1.62$, $df=23$, 47, $p>.05$-- not significant) and the delayed posttest ($F=1.18$, $df=23$, 47 $p>.05$ -- not significant).

The means and standard deviations for the two treatment groups are presented in Table 1.

Table 1

Means and standard deviations
of pretest, immediate and delayed
posttests for both treatment groups.

	Individualized group n = 48		classroom group n = 24	
	Mean	standard deviation	Mean	standard deviation
Postest	9.31	4.27	4.37	4.02
Immediate Posttest	34.77	2.44	31.75	3.11
Delayed Posttest	33.56	3.00	31.37	3.27

The assumption of the homogeneity of regression was tested by comparing the slopes obtained between the two treatment groups. This was done running separate multiple regressions for each group using pretest and both posttests scores. The slopes, ranging from .2 tö .8, are presented in Table 2.

By examining the 95% confidence intervals associated with each slope, the assumption of common slopes was found to be tenable on both the immediate and delayed posttest.

Table 2

Slopes and 95% confidence intervals
for the slopes, between pretest and
immediate and delayed posttest scores

| | Individualized group n=48 | | Classroom instruction n=24 | |
	Slope	95% Confidence Internal	Slope	95% Confidence Internal
Immediate Posttest	.18	.02 to .34	.13	−.21 to .47
Delayed Posttest	.18	−.02 to .38	.12	−.23 to .48

The results of the analysis of covariance presented in Table 3 indicate significant differences (p=.004) between the two treatments on the immediate posttest when the pretest scores are used as a covariate. The pretest scores were found to have a significant effect (p=.001) when used as a covariate.

Table 3

Results of the analysis of covariance on
the immediate posttest using pretest scores
as a covariate

Source of variation	Sum of squares	Degrees of freedom	Mean square	F	Signifi-cance of F
Covariate (Pretest)	120.232	1	120.232	17.667	.001
Treatments	59.177	1	59.177	8.696	.004
Residual	469.577	69	6.805		
Total	648.986	71			

The analysis of covariance performed on the delayed posttest scores were not significant (p=.119). (See Table 4). However, had the pretest scores not been included as a covariate, significant differences would have been found on the delayed posttest (p=.006) as well as the immediate posttest (p=.001).

Table 4

Results of the analysis of covariance on
the delayed posttest using pretest scores as
a covariate

Source of variation	Sum of squares	Degrees of freedom	Mean square	F	Signifi-cance of F
Covariate (Pretest)	86.806	1	86.806	9.415	.003
Treatments	22.994	1	22.994	2.494	.119
Residual	636.200	69	9.220		
Total	746.000	71			

Examination of the means revealed that the students who studied using the package obtained significantly better results than the students receiving the traditional classroom instruction. The means and adjusted means are presented in Table 5.

Table 5

Means and adjusted means for both
treatment groups

	Individualized group	Classroom group
Means	34.77	31.75
Adjusted means	34.50	32.29

The dependent t-test between pretest and immediate posttest scores was performed separately for each treatment group. The results showed a significant increase in learning according to the change in the test scores for both treatment groups. (See Tables 6 and 7). —

Table 6

Results of the dependent t-test between the pretest
and the immediate posttest for the individualized group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2 tail prob.
Pretest	9.31	4.27				
			-25.46	-41.97	47	.000
Immediate Posttest	34.77	2.44				

Table 7

Results of the dependent t-test between the pretest
and the immediate posttest for the classroom group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2-tail prob.
Pretest	4.37	4.02				
			-27.37	-28.83	23	.000
Immediate Posttest	31.75	3.11				

The dependent t-test was also performed between the pretest and
the delayed posttest for each treatment group. Both differences were
significant at the .001 level. The results are presented in Tables 8
and 9.

Table 8

Results of the dependent t-test between the pretest
and the delayed posttest for the individualized group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2-tail prob.
Pretest	9.31	4.27				
			-24.25	-37.00	47	.000
Delayed Posttest	33.56	3.00				

Table 9

Results of the dependent t-test between the pretest
and the delayed posttest for the classroom group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2-tail prob.
Pretest	4.37	4.02				
			-27.00	-27.66	23	.000
Delayed Posttest	31.37	3.26				

The dependent t-test between immediate posttest and delayed post-
test showed a significant decrease in learning according to the change in
test scores in the individualized group. However, there is a non signi-
ficant decrease for the same comparison in the classroom group. (See
Tables 10 and 11).

Table 10

Results of the dependent t-test between the immediate
posttest and the delayed posttest for the individualized
group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2-tail prob.
Immediate Posttest	34.77	2.44				
			-1.21	5.47	47	.000
Delayed Posttest	33.56	3.00				

Table 11

Results of the dependent t-test between the immediate
posttest and the delayed posttest for the classroom
group

	Mean	Standard deviation	Difference mean	t-value	Degrees of freedom	2-tail prob.
Immediate Posttest	31.75	3.10				
			.37	1.16	23	.258
Delayed Posttest	31.37	3.27				

Hypothesis Three

The third hypothesis - that variables such as learning style, age
and sex of students would affect posttest scores differentially in the
two treatment groups - was confirmed in part.

The results will be reported separately for each one of the
variables mentioned (i.e., learning style, age and sex).

Learning Style preferences

Students were divided into three groups according to the results
obtained in the questionnaire administered to) the students for purposes
of determining learning style preferences   (See appendix C).

First group - Students who showed strong preference for studying with
a print self - instructional package.

Second group - Students who can study using a print self - instructional
package, but who would also like to receive the information
through another teaching method.

Third group   -   Students who would strongly dislike using a print self -

                     instructional package, preferring instead to receive the

                     information from other kinds of materials or teaching

                     methods.

       The distribution of the subjects in these three groups is presented in Table 12.

Table 12

Distribution of the subjects in three
learning style groups

Number of Students		
Learning style group	Individualized group	Classroom group
First group	22	8
Second group	19	10
Third group	7	6
	n=48	n=24 = 72 subjects

       The results derived from this study indicate significant relation-ships between the learning style group and the scores on both the immediate and delayed posttests for each treatment group. However, the results were exactly the opposite for each treatment group, as will be discussed later.

       Two methods of investigating the relationship between learning style preference and treatments were used in the analysis:

a) the correlation coefficients between learning style group and the posttest scores were calculated and compared for the two treatment groups.

b) the two - way interaction between learning style and treatment was examined:

<u>Correlation</u>. There was a significant negative correlation of -.55 (p<.005) between the learning style group and the immediate posttest scores and a significant negative correlation of -.46 (p<.005) between the learning style group and the delayed posttest scores of the group studying with the package (See Table 13).

The negative sign of the correlation demonstrates that high scores on the posttests were paired with low scores on the Learning Style questionnaire, indicating that those who preferred learning with self - instructional materials (<u>e.g.</u>, learning style preference = 1) actually did better on the posttest.

On the other hand, there was a significant <u>positive</u> correlation of .66 (p<.005) between the learning style group and the immediate posttest scores and there was a significant <u>positive</u> correlation .59 (p<.005) between the learning style group and the delayed posttest scores in the group receiving the classroom instruction.

The positive sign of the correlation demonstrates that high scores on the posttest were paired with high scores on the Learning Style questionnaire, indicating that those who preferred learning with the traditional classroom situation (<u>e.g.</u>, learning style preference = 3) actually did better on the posttests.

Table 13

Correlations between learning style
group and posttests for both treatment
groups

	Individualized groups	Classroom group
Immediate Posttest	r = -.55	r = .66
Delayed Posttest	r = -.46	r = .59

Two way - interaction. Average score on the posttests of the students in each treatment group divided up according to learning style preference is presented in Table 14.

Table 14

Students' average score on the posttests
in each treatment group divided
up according to Learning Style preference

Learning Style Group	Individualized Group		Classroom Group	
	Immediate Posttest	Group Posttest	Immediate Posttest	Delayed Posttest
First group	35.86	34.64	29.85	29,37
Second group	34.63	33.53	31.50	31.10
Third group	31.71	30.28	34.00	34.50

The results of the two - way analysis of variance between treatment and learning style group indicates that there is a significant two - way interaction between the treatments (i.e.; learning with the package and the lecture method) and the learning style preference of students (1, 2 or 3).

The two - way interaction is significant at the .001 level in both immediate ($F_{2,66}$ = 20.097) and delayed posttests ($F_{2,66}$ = 13.001). Even when pretest scores are adjusted for by analysis of covariance procedures, this two - way interaction is still significant at the .001 level. ($F_{2,65}$ = 17.935 for the immediate and $F_{2,65}$ = 11.385 for the delayed posttest).

Graph illustration the two - way interaction between treatment and learning style group on the immediate posttest is presented in Figure 3.
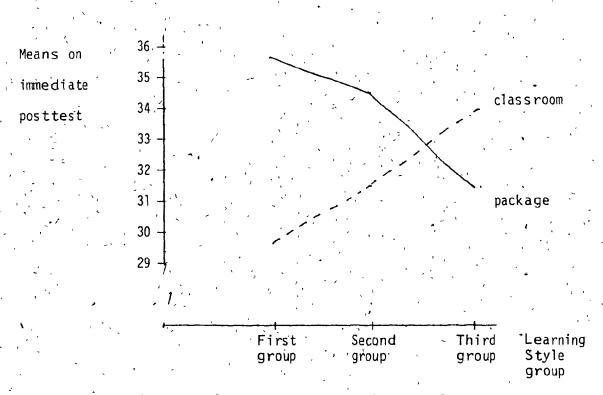

Figure 3. Two way interaction between treatment and learning style group for immediate posttest

First group = like individualized learning
Second group = neutral
Third group = dislike individualized learning

Graph 4 illustrates the two - way interaction between treatment and learning style group on the delayed posttest.
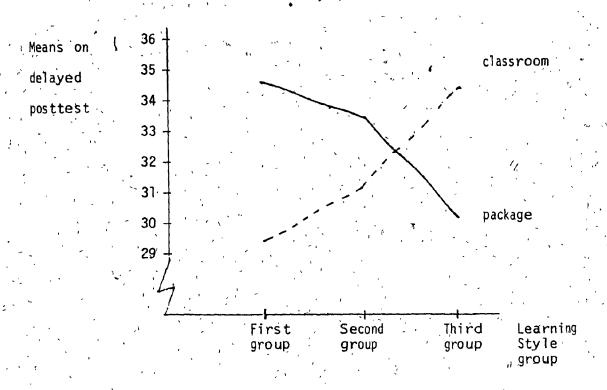

Figure 4. Two way interaction between treatment and learning style group for delayed posttest.

First group = like individualized learning.
Second group = neutral
Third group = dislike individualized learning

Age

The distribution of students according to age is presented in Table 15.

Table 15

Distribution of subjects according to
age in both treatment groups

Years old	Frequencies	
	Individualized group	Classroom group
17	2	1
18	18	3
19	9	2
20	5	8
21	3	4
22	1	1
23	4	1
24	3	1
25	0	1
28	1	0
29	0	1
31	0	1
32	1	0
39	1	0
	n = 48	n = 24 = 72 subjects
Median age =	Med = 19	Med = 20

Students in both group (i.e., those studying with the package and those receiving classroom lecture) tended to concentrate in the 18 to 20 age bracket.

In the group studying with the package a great number of students

was located in the 18 year old group, while in the group receiving traditional lecture, the 20 year old group constituted the bigger number.

The correlation coefficients between age and the immediate and delayed posttest scores were claculated and compared for the two treatment groups. The results are presented in Table 16.

Table 16

Correlations between age and posttest
for both treatment groups

	Individualized group	Classroom group
Immediate Posttest	r = .067	r = .069
Delayed Posttest	r = .036	r = .076

The results of the correlation are not statistically significant. This means that age does not appear to be a factor which affects the students' performance in a linear manner.

In order to see if a non-linear relationship between age and treatment exists, students were grouped into three different levels according to age. The average of the scores in the immediate and delayed posttest indicates that in the group where students studied with the package, older students performed better than their younger counterparts, while in the group where students received classroom lecture, it was the opposite. This difference, although interesting was not found to be statistically significant when measured by a two - way interaction between age and treatment on either the immediate posttest (p = .544) or the delayed

posttest (p = .935).

The average score of the subjects according to age is presented in Table 17.

Table 17

Average score of subjects according to age
in both treatment groups

Group of Age	Individualized Group		Classroom Group	
	Immediate Posttest	Group Posttest	Immediate Posttest	Delayed Posttest
First group Under 20	34.82	33.69	33.00	32.00
Second group between 20 and 25	34.44	33.19	31.31	31.12
Third group over 25	36.00	34.33	31.50	31.50

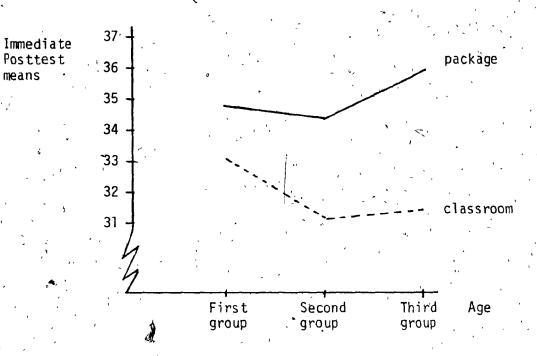A graphic representation is shown in Figure 5.

Figure 5. Graph of immediate posttest means broken down
by treatment and age.
First group - students under 20
Second group - students between 20 and 25
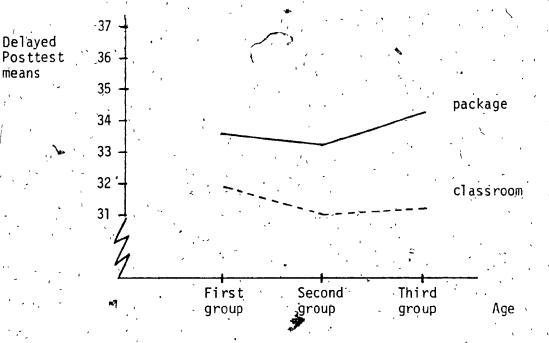Third group - students over 25

Figure 6: Graph of delayed posttest means broken down
by treatment and age.
First group   -   students under 20
Second group -   students between 20 and 25
Third group   -   students over 25

Sex

Sex is another variable examined in this study to determine
whether it affects the results obtained in the study.

Table 18

Distribution of the subjects according to sex

Sex	Individualized group	Classroom group
Male	15	13
Female	33	11
	n = 48	n = 24

72

The correlation coefficients between the sex of the subjects and the scores on the immediate posttest as well as the delayed posttest were calculated. The results are presented in Table 19.

Table 19

Correlations between sex of subjects
and posttests for both treatment groups

	Individualized group	Classroom group
Immediate Posttest	r = .141	r = -.089
Delayed Posttest	r = .052	r = -.082

None of the correlation coefficients were significant.

Taking into account the average score of the students according to their sex, the results indicate that female students studying with the package obtained slightly better results than the male students. In the group receiving a traditional class lecture, however, male students obtained slightly better results than female. Examining the two - way interaction between sex and treatments leads to the conclusion that this interaction was not significant on either the immediate posttest (p = .361) or the delayed posttest (p = .596).

The average score of the subjects according to sex is presented in Table 20.

Table 20

Average score of the subjects according
to sex in both treatment groups

Sex	Individualized group		Classroom group	
	Immediate Posttest	Delayed Posttest	Immediate Posttest	Delayed Posttest
Male	34.26	33.33	32.00	31.61
Female	35.00	33.36	31.45	31.09

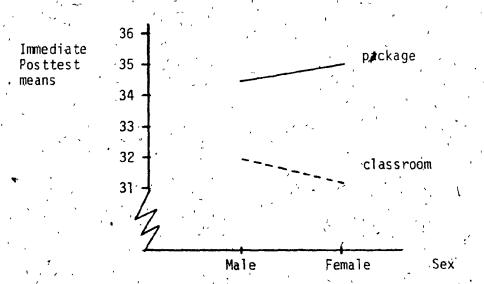The results are presented graphically in Figure 5.

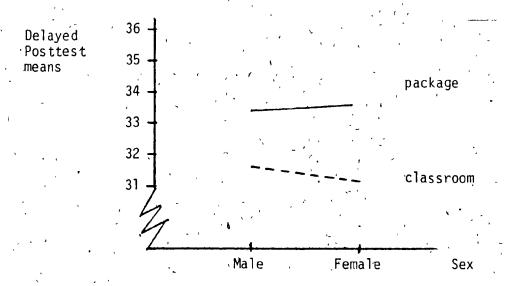Figure 7. Graph of immediate posttest means broken down
by treatment and sex.

Figure 8. Graph of delayed posttest means broken down by treatment and sex.

Hypothesis Four

The fourth hypothesis - that students who spend more time working with the package would score higher on the posttest than students who spend less time with the package - was confirmed.

A positive correlation of .55 was observed between the time spent working with the package and the scores obtained by the students. This correlation coefficient was significantly different from 0 at the .005 level.

The time students spend working with the package is also an important variable to consider in this study; the rationale behind this is the widely - held belief that students using an individualized technique can learn better because they have the option to study at their own pace (Gagné and Briggs, 1974; Kemp, 1980; Mitchell, 1980) and thus, if they need more time to master the materials, they can follow this option.

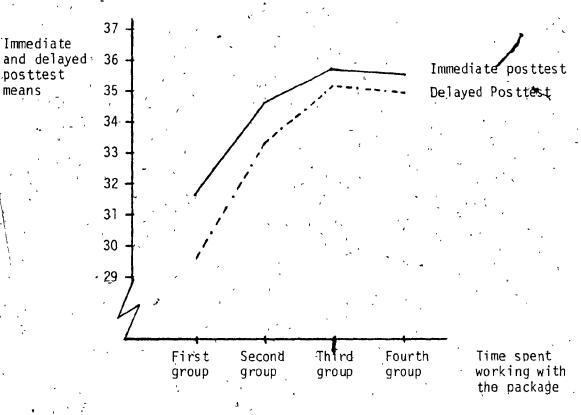The students in the individualized group were told before the

distribution of the package that the approximate time to work with the package was about 20 hours. However, they were also told that they could spend more or less than 20 hours according to their preferences. Moreover, they were instructed to finish studying it within three weeks because of the constraints imposed by the university where the study was undertaken.

For interpretation purposes, students were divided in four groups according to the number of hours they spent working with the package. A distribution of the students according to these four groups and the average score on the immediate and delayed posttest are presented in table 21. The average time spent by students while working with the package was 25.58 hours.

Table 21

Average score on the posttests and distribution of the students according to the number of hours they spent working with the package

Group	Number of hours	Number of students	Mean on the immediate posttest	Mean on the delayed posttest
1st group	15 - 20	8	31.62	29.62
2nd group	21 - 25	16	34.68	33.12
3rd group	26 - 30	18	35.89	35.22
4th group	31 - 35	6	35.83	35.00

A graphic representation of this distribution is presented in Figure 9.

Figure 9. Illustration of the relationship between both
posttests and the number of hours spent working
with the package.

Note: First group = 15 to 20 hours
Second group = 21 to 25 hours
Third group = 26 to 30 hours.
Fourth group = 31 to 35 hours

Evaluation of the self - instructional package

The self - instructional package which was planned and implemented
in this study, was also evaluated by the students who used it.

An evaluation form- consisting of 10 five - point rating scale
and 3 open - ended questions which required answers to be supplied by the
respondent - was presented to the students in order to determine their
attitude toward the materials they worked with. Copies of the evaluation
form in both English and Spanish are included in appendix D. To make

the interpretation of the results of the rating scale uniform, a score of 5 was always assigned to the most favourable category and a score of 1 to the least favourable category.

An example of one of the rating scale items follows:

Objectives

1. The objectives of the package were not clear.   1   2   3   4   5

The objectives of the package were very clearly defined.

Means and standard deviations of items 1 to 10 are presented in Table 22.

Table 22

Means and standard deviations of
items 1 to 10 from the rating scale
evaluating the package

Item	Mean	Standard deviation
1	4.87	.33
2	4.95	.20
3	4.85	.41
4	4.75	.52
5	4.75	.48
6	4.95	.20
7	4.73	.49
8	4.83	.43
9	4.60	.61
10	4.85	.35

Note: Each of the above items were evaluated on a 5 - point scale where 1 was least positive and 5 was most positive.

The students responded very positively with average ratings close to 5 in every case. This indicates that they felt extremely positive about the objectives, content, organization, presentation, motivation, instructions, vocabulary, exercises, supplementary materials and over-all value of the package.

The results of items 11, 12 and 13 are presented individually for each item.

11. Which part did you find most valuable? Why?

The 48 students who studied the package answered this question as follows:

21 responded that they found the First Section most valuable. They gave the following reasons:

The first section was

better explained	4
more interesting	6
clearer	9
the basis for 2nd section	2
	21

12 responded that they found the Second Section the most valuable. They gave the following reasons:

The second section was

more interesting	4
clearly explained	3
more motivating	2
something new	3
	12

14 students said that the entire package was valuable. The reasons they gave are:

Both sections were clear and precise	2
Everything was clearly explained	5
It was very interesting	2
It facilitated learning	2
Everything discussed was related to the subject matter	3
	14

1 student said that <u>the examples in general</u> constituted the most valuable part because:

> They made learning easier   1

12. Which part did you find least valuable? Why?

5 students thought that the least valuable part was the <u>Second Section</u> because:

> It was more complicated   5

1 student said that the least valuable part was the <u>First Section</u> because:

> It was less interesting than the Second Section   1

3 students replied that the least valuable part was the <u>supplementary materials</u> for the following reasons:

> They were repetitive   1
> They were too long   1
> The vocabulary used
>   was difficult   1
>   3

2 students said that the least valuable part was the specific topic, <u>the data</u> because:

> It was not discussed clearly   1
> It required more explanation   1
>   2

37 students said that <u>no part</u> was less valuable because:

> The entire package was interesting   16
> Everything was related   4
> The entire package was clear   5
> The package facilitated learning   3
> Everything was well explained   2
> The entire package was valuable   7
>   37

13. Would you like to study again using a self - instructional package? Why?

1 student - undecided
47 students -yes

Reasons
I prefer to attend a regular class

Makes me responsible	5
Facilitates learning	13
It is interesting	6
It is motivating	2
Less pressure to study	6
It can be used anytime and anywhere	11
I can work at my own pace with teacher's help	4
	37

Evaluation of the test

Test - retest reliability for the posttest -- calculated by taking the correlation between the immediate posttest and the delayed posttest -- was found to be .88 for the classroom group and .86 for the individualized group.

Coefficient alpha reliablity -- calculated using the responses of the combined groups, namely the individualized and classroom groups, on the immediate posttest -- was found to be .63 for the 26 item test.

Item difficulty indices and item discrimination indices based on the responses of the individualized group in the immediate posttest are reported in Table 23.

Table 23

Item discrimination and item difficulty
indices according to the responses of the individualized
group on the immediate posttest

Item Number	Item difficulty	Item discrimination
1	0.96	0.48
2	0.95	0.36
3	0.98	0.20
4	0.92	0.59
5	0.95	0.25
6	0.94	0.63
7	0.94	0.63
8	0.96	0.35
9	0.94	0.33
10	0.98	0.05
11	0.89	0.02
12	0.83	0.33
13	0.92	0.41
14	0.89	0.25
15	0.94	0.44
16	0.92	0.16
17	0.96	0.20
18	0.94	0.19
19	0.92	0.22
20	0.98	0.05
21	0.96	0.07
22	0.96	0.07
23	0.92	0.28
24	0.89	0.62
25	0.96	0.02
26	0.96	0.20

The item difficulty indices ranged from .83 to .98, indicating that all the items were fairly easy (appropriate for a mastery learning situation).

Item discrimination indices ranged from .02 to .63. None of them were negatively discriminating.

CHAPTER V

Discussion

This chapter endeavors to discuss the results of the present study, which were reported in the previous chapter, by pointing out certain features that are relevant.

From the four hypotheses proposed in this study, two were confirmed with statistical support. These hypotheses were hypothesis one -- the group receiving self - instructional package would perform better on the immediate posttest than the group receiving classroom instruction -- which was found to be statistically significant (p = .004), and hypothesis four -- time spent working on the package would be positively related to posttest scores -- (t = .55, p = .005). Hypothesis three -- that age, sex and learning style preference would affect performance -- was confirmed in part because learning style preference was found to interact with the treatments significantly. More detailed comments are presented:

Hypothesis One - It was hypothesized that students receiving information from an individualized package would perform better in the immediate posttest than students receiving traditional classroom instruction. This hypothesis was supported with a significance level of .004. However, if the pretest scores were not taken into account as a covariate, the results on the immediate posttest could have been significant at the .001 level.

Difference in the means revealed that students who studied with the package obtained significantly better results ($\bar{X}_p$ = 24.77), than

students receiving the traditional classroom instruction ($\overline{X}$ = 31.75). The differences between the adjusted means when the pretest was used as a covariate were also significant ($\overline{X}_p$ adjusted = 34.50) for the individualized group and ($\overline{X}_c$ adjusted = 32.29) for the classroom group.

These results show that students under individualized instruction acquired more knowledge than students under the traditional lecture method.

The mastery level achieved by students in the two treatment groups is another way to demonstrate the difference in acquired knowledge between one group and the other.

In the individualized group made up of 48 students:

0% of the students achieved 60% mastery

4% of the students achieved 70% mastery

10% of the students achieved 80% mastery

40% of the students achieved 90% mastery

46% of the students achieved 100% mastery

While in the classroom group made up of 24 students:

4% of the students achieved 60% mastery

21% of the students achieved 70% mastery

42% of the students achieved 80% mastery

21% of the students achieved 90% mastery

12% of the students achieved 100% mastery

These results seem to indicate that the lecture method of instruction is not the best mode to transmit information if the results are to be effective. These results strengthen the findings of McLeish (1968), that the lecture method is not always the most effective technique for all the students. One of the reasons that the self - instructional package may have been so effective is because students using the package, were allowed to study according to their individual preferences (Cooley & Glaser, 1971).

Students working with a package can work at their own pace and take the package anywhere they want to study. These facets reflect the theme of freedom to study, without any pressure imposed by a schedule. This helps students learn more effectively   (Manwaring, 1976; Moore et. al., 1977-78).

Most of the students who participated as subjects in this study reported that this was their first experience working with an individualized package. At the beginning of the study, students in the package group felt a bit lost. However, the presence of a tutor motivating and guiding them whenever the need arose, helped to make them feel more comfortable and secure during their learning activity.

The results seem to indicate that the presence of a tutor -- encouraging and guiding the students while they study the self - instructional materials -- helps make the students feel more confident that they can perform the task. This result supports the findings of Wilkinson (1979) who also emphasized the importance of a tutor's role in a self - instructional activity.

Even though the students did not frequently ask for assistance from the tutor, they said that they felt "all the time" that they could always approach the tutor for additional explanation, in the event of a problem.

Another aspect that may have contributed to the good performance using the package was the students' knowledge of the fact that the score they obtained on the test, was going to make up one-third of their final mark in the course (scientific method). Consequently the students really concentrated and tried their best to obtain a good mark which would improve their final mark in the course. This strongly motivated students to study the package seriously and deeply.

For the classroom group, the results obtained from the three -
week session of classroom instruction -- for   purposes of this study
-- were also taken into account as one-third of the final mark. The
difference was that for these students the classroom instruction was not
a new and different experience. The only new element was the presence
of a different teacher (the researcher) for the three - week session.

Hypothesis Two - that students using the package would score
higher in the delayed posttest than students receiving information in
the classroom - was not confirmed. However, if the pretest scores were
not taken into account as a covariate, the results on the delayed posttest
would have been statistically significant (p = .006).

The results obtained in the delayed posttest show a significant
decrease, as compared to the immediate posttest scores, in the group
with the package. In the classroom group the decrease detected from
the immediate to the delayed posttest scores was not significant.

These results seem to indicate that if students learn better
using a self - instructional package than students in the traditional
classroom situation, probably the students in the classroom retained the
information (measured by the immediate posttest) with less of a loss
than students studying the package. This results do not agree with the
findings of Pask (1976) and Dunn & Dunn (1978) who said that students
tend to retain information longer if their learning style preference is
matched with the teaching method used.

However, it is also important to remember that the package group
did perform significantly better on the delayed posttest than the class-
room group (p = .006) when the pretest scores were not used as a covariate.
Thus retention as measured by the delayed posttest was generally better
for the package group, but retention was only significantly better if

the groups were not adjusted by their initial knowledge of the material.

A possible reason why students in the package group suffered a significant decrease from the immediate posttest to the delayed posttest while the classroom group had only a non significant decrease, could be the fact that students in the individualized group were surprised when they were asked to repeat the test once more. The reason for this negative reaction was that they did not want to answer the test again for fear of losing the mark they had already received earlier. Once assured by the professor -- who disclosed all these findings to this researcher -- that the mark would stay unchanged, they proceeded to write the test (The professor who administered only the delayed posttest was the professor teaching the scientific method course during the term the study was undertaken. This researcher asked him to do so since this researcher was already in Canada during the delayed posttest.)

The classroom group took the test as a matter of course, although the students were not very enthusiastic about it. They did not react with as much surprise as the individualized group.

Hypothesis Three - that variables such as learning style, age and sex of the students would affect the outcomes of this study - was confirmed in part, applying only to the first variable (i.e., learning style).

The significant two - way interaction (p = .001) between learning style preference as measured by a learning style questionnaire and treatment indicates that students can indeed identify ways to learn which are most successful for them. In effect, if the information is not presented in the way they prefer, the results might not turn out as well as if this situation is taken into account. These results are consistent with the findings of Pask (1976) and Dunn & Dunn (1978).

Students who showed a high inclination toward studying using a self - instructional package, obtained the highest scores in the individualized group and the lowest scores in the classroom group, while students who showed a low inclination toward studying using self - instructional packages performed best in the classroom group and worst in the individual group.

These results indicate that certain students possess the capacity to study using a package similar to the one used in this study, and they can identify this capacity before using a package by completing the learning style questionnaire and claculating their score. These students like to study by themselves, they like to receive written information, and they prefer to have an interaction with a tutor. However, other students do not like to study following this structure and they can identify their preference for other methods of instruction again through completing the learning style questionnaire. These individuals prefer to attend a regular class or to study using different kinds of materials other than packages such as the one used in this study.

If the students' preference for a certain method of instruction were taken into account, so that they were assigned to one group or another (i.e., individualized group or classroom group) according to their choice, students would tend to maximize their success.

Age

According to the results obtained from this study, age does not appear to be a factor which affects the students' performance in a linear manner. The correlation between age and posttest scores was not significant either in the individualized group ($r = .07$) or in the classroom

group (r = .07).

Although no significant effects were found to support this variable as a factor which affects the outcomes, however, slight performance differences according to age were found:

Older students performed better in the individualized group than their younger classmates. But younger students performed better in the classroom group, than the older counterparts.

One of the possible reasons for these results could be that older students are more responsible and have learned how to study on their own. And, since some of them are working students, a self-instructional situation helps them to accommodate their study schedule to their needs and eliminates the necessity of them having to attend a regular class if they choose not to.

Younger students generally are not working - students; consequently, they do not feel the need to adjust their study schedule and perhaps prefer to study in a classroom situation because they do not have to do everything by themselves.

Sex

Sex, like age, is a factor that appears to have no significant effect on the outcomes of this study. The correlation between posttest scores and the sex of students was not significant for either the immediate or for the delayed posttests (see Table 19). Nor was there a significant two - way interaction between sex and treatment.

But once again (as with age) results showed a slight difference in each treatment group. In the individualized group female students performed better than males, and in the classroom group male students

performed better than females.

Perhaps, in this study, more female students preferred to study using a self - instructional package, and more male students preferred to attend a regular class.

In order to check out this hypothesis a two - way contingency table of sex by learning style group was created.

Table 24

Two - way contingency table of sex and learning style

Learning style group

Sex	Group 1	Group 2	Group 3
Male	7	14	7
Female	24	14	6

From the table, it is obvious that a higher proportion of females were found to prefer self - instructional packages or the traditional classroom instruction.

The relationship between the learning style preference and sex was found to be significant at the .05 level when tested using the Chi-square distribution (X^2 with 2 d.f. = 6.148 > 5.99).

Hypothesis Four -- that those students who spend more time working with the package would score higher than students who spend less time with the package -- was confirmed.

The correlation obtained (r = .55) between the time spent working with the package and the scores, indicates a strong relationship between the two factors.

One of the advantages of individualized instruction is that students can spend the time they need to work with the materials, and they can stop the activity when they feel like it (Mitchell, 1980). This means they can work at their own pace (Manwaring, 1976; Moore et al., 1977-78).

It is logical to think that students who spend more time working with the package, can perform better than students who devote less time to the package.

In a learning event where a self-instructional package is used, students can spend only the time they really need to master the subject matter . On the other hand, in the classroom situation, students attend the class according to a fixed schedule and generally are not directed adequately toward outside work. Consequently, they lack interest in continuing to work with the information acquired in class.

The average time spent by students while working with the package was 25.58 hours, which is a little bit more than the previously calculated time of 20 hours.

According to the results of this study, time is an important factor to consider while using individualized instruction if the results are to be effective. Students must have enough time to master the knowledge they are acquiring.

The results of this study suggest that students who spent between 26 and 30 hours working with the package (see Figure 9), performed better than the students who spent less time, and slightly better than students who spent more than 31 hours.

The reason for this results could be that the optimum time to study this package is from 26 to 30 hours, so that if students spend

more time, they are just overlearning the material. But if students
spend less time than necessary, the results might show negative effects.

Evaluation of the self - instructional package

The package used in this study was evaluated by the students who
used it.

Evaluation results indicate that students in general liked the
package. They responded very positively to the evaluation form adminis-
tered for this purpose (see appendix D). The results of the evaluation
form were very positive (see Table 22) and indicated that students felt
comfortable while working with the package.

The students commented on some weaknesses of the package. For
example, they said that some parts were too long, while some were too
short. They felt that some parts required additional information (see
page 68). However, the results of this evaluation seem to show that
students, really liked working with the package. From 48 students, only
one was undecided whether or not to work with a similar package again.
The rest of the students reported that they would like to study again
with a package similar to the one used in this study. They gave different
reasons why they felt comfortable while working with the package. One
reason that most of the students gave is that the package facilitated
learning and gave them the "freedom" to study anytime and anywhere they
wanted to (see page 69).

Evaluation of the test

The test used as a pretest and posttest in this study was also evaluated to determine its reliability.

The results in the test - retest reliability were strong for both individualized group (.86) and classroom group (.88). These results indicated that the test was stable over time.

Coefficient alpha reliability was also calculated using both treatment groups on the immediate posttest. It was .63 which is a bit low, indicating that not all of the items were homogenous.

Item discrimination indices ranged from .02 to .63. None of the items were negatively dicriminating. However, for six of the items in the test, the discrimination indices were very close to 0 (see table 23). Those questions should be revised for future applications of the test. This would probably improve the internal consistency of the test and thus raise the coefficient alpha reliability estimate.

Item difficulty indices ranged from .83 to .98, indicating that all the items in the test were fairly easy (which is appropriate when a mastery learning situation is expected).

CHAPTER VI

Conclusions

Based on the results of the statistical analysis and the dis-
cussion of the results obtained in the present study, the following
conclusions can be drawn:

1. Print self-instructional packages with tutorial assistance offer
   many advantages within the particular context of the University
   of Aguascalientes. Some of these advantages are:

   a) Students who study with a package can obtain more effective
      learning than those who receive traditional classroom
      instruction.

   b) A greater number of students can take the course at the same
      time. This helps to solve the problem of an overpopulation
      of students and a shortage of teachers.

   c) Teachers using packages would have the opportunity to parti-
      cipate in more varied and productive academic actitivites in
      the university instead of working in the classroom explaining
      the subject matter over and over. Teachers would have the
      opportunity to: i) prepare their own packages; ii) improve
      their packages; iii) engage in the implementation of
      research projects; and iv) engage in team teaching.

   d) Students studying with self-instructional packages generally
      consider this learning situation to be positive and inter-
      esting.

   e) Students report that they tend to feel freer because they
      can work with the materials without time pressure.

f) Students seem to appreciate having a tutor available while working with the package.

g) If motivated properly, these students can find this mode of instruction helpful in enabling them to assume more responsibility for their learning.

On the other hand, there are some disadvantages that may be associated with print instructional materials. Some possible disadvantages may be the following:

a) If students are not properly motivated, they may not perform as well as expected.

b) If the package is not correctly designed (according to learner characteristics), the results may not be as good as expected.

c) If the package is too long, chances are that students' interest in working with the materials may decrease considerably.

d) If a questionnaire to detect students' learning style preference is not administered before distributing the package, it is possible that certain students would not like to study using a self-instructional package, which could negatively affect learning.

2. Learning style preference appears to be a vital aspect to consider prior to the selection of any medium of instruction. If the package is given to students who prefer working individually, the results obtained will probably be considerably better.

3. Sex and age of students are factors which do not appear to exercise important influences on the results of learning situations in which students work with print self-instructional

packages. However, the relationship detected between sex and learning style preference, where female subjects strongly preferred to study using self-instructional packages as opposed to the male subjects, suggests that more females will select this medium of instruction.

4. The length of time it takes the students to complete the self-instructional package appears to be an important factor to consider if this instructional medium is to be employed. Students can set their study pace according to their capabilities and needs. Hence, teachers who use self-instructional packages should allow enough time to complete the package so that even slow students do not feel any time pressure. Between 26 to 30 hours appears to be an optimum allocation of time for the package used in this study.

Contributions for further research and development

1. Packages like the one used in this study in the context of the University of Aguascalientes. They can be used as an alternative to the classroom teacher. This way information can be presented more effectively than the traditional lecture method. The aspects mentioned earlier, however, must not be ignored if the benefits from this medium of instruction are to be obtained.

2. Learning style preference appears to be an important indicator of performance on self-instructional materials as measured by the learning style questionnaire developed by this author. These findings open up the area for further research.

Limitations of this study

1. The results of this study may not be generalizable to other instructional materials. The results apply only to this particular print self-instructional package in the university where it was tested.

2. This study applies only to print self-instructional packages. Its use in combination with other media (television, slides, etc.) could produce different results.

3. The consideration of other variables like 'reading ability', could provide important findings that could serve to explore more thoroughly other aspects of this study that were not touched in this undertaking.

4. The random assignment of subjects to treatment groups would have improved the generalizability of the results.

Recommendations

In light of the specific results of this study, some aspects must be considered if self-instructional packages are to be used:

1. Students must be properly motivated to work with this type of materials by presenting them with the advantages which are offered.

2. Tutorial assistance should be available to motivate, encourage and guide the students during the time they are studying the package.

3. Students' learning style preference should also be considered as an important factor before recommending this medium of

instruction. A learning style questionnaire should be admin-istered to determine the students' preferences for a particular mode of instruction.

4. Students should have a long enough time depending on their individual needs, within which to study the package without time pressure.

5. Students may not want to study very long packages. It is recommended then, that a package be used -- especially if this will be the students' first encounter with individual work -- for certain segments of the complete course.

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APRENDICES.

APPENDIX A

Instructions to students on the use of the package

This lesson was prepared for you to help you learn by yourself, without having to attend a class regularly. All you have to do is to follow the instructions carefully. The lesson is about scientific method.

Please read the instructions carefully and if you have any questions about them -- or about the package when you read it -- your adviser will be around to help you, in order that you may obtain the best results.

The purpose of the lesson and the instructions for its use follow :

Purpose and objectives

The purpose of this package on Scientific Method is to present a general view of the importance of rigorously following a research method to achieve one of the main objectives of science: its growth and development.

Another purpose of this package is to motivate you to study more about the scientific method.

More specifically, this package will enable you to obtain the following objectives. After studying the package and doing the excercises you will be able to:

1. Define science as a body of rational, exact and verifiable knowledge and also as a valuable tool for dominating nature and changing society.

2. Make a distinction between scientific knowledge and common sense knowledge by giving concrete examples of each.

3. Differentiate between formal sciences and factual sciences, considering that the factual sciences have to be observed and/or experimented

on, to confirm their conjectures or suppositions. The formal sciences, meanwhile, require no experimentation.

4. Give two concrete examples of factual ideas, and two examples of formal ideas. Explain why they are formal or factual.

5. Distinguish between science and technology (taking into consideration the aspects of theory and practice) by giving concrete examples of each.

6. Distinguish between social sciences and natural sciences by selecting them from a given list.

7. Identify the scientific method as a rigorous tool which helps scientists with their work by showing them the steps to be followed in research in order to obtain more valid results.

8. Identify the steps to be followed - according to the scientific method of reserach - explaining their role in the entire process.

9. Point out the activities to be done while formulating the problem research statement. This includes problem definition and problem distillation and explaining the importance of observing each step.

10. Explain the role of the hypotheses in the scientific research process.

Study Guide

The structure of this package will be described in detail a little later. The structure is also summarized in the flow chart presented after the description.

Approximately 20 hours of your time will be needed, to work with the package and to do the exercises. However you can work at your own pace so that you can finish the entire task in less than or more than 20 hours.

The package begins with a general introduction which gives you a general view of the topic discussed in the package.

The package is divided into two sections, both of which explain different concepts related to the scientific method. These concepts were established earlier in the section describing the objectives of the package.

Each section has two sets of exercises. Each set consists of several questions. Some of the questions are constructed with the purpose of summarizing the recently acquired knowledge in that particular part of the package. Other questions, meanwhile, will require your active participation (i.e., reading or consulting supplementary materials) to enable you to acquire the knowledge needed to appreciate the next section in the package.

At the end of the package, some articles and supplementary materials will be added to help you answer some questions in the exercises. Refer to them whenever necessary. Also included is a reference section, consisting of some books that could be useful in case you want to know more about the subject matter.

After each question, you will find a blank space right afer a line (XXXXXXXXXX). This space is for your answer; if the space is not enough for your answer, please write your answer on a sheet of paper and staple it right on the blank space. The answer for each question is provided after a series of Xs; this way you can check if your answer is correct. In case of a wrong response, the answer provided can help explain why you did not get the right answer. It will be convenient to use a sheet of paper or a piece of cardboard to cover the answers while studying. This will keep you from looking at the answers at once. This would also give you the chance to analyze the question, resulting in more productive
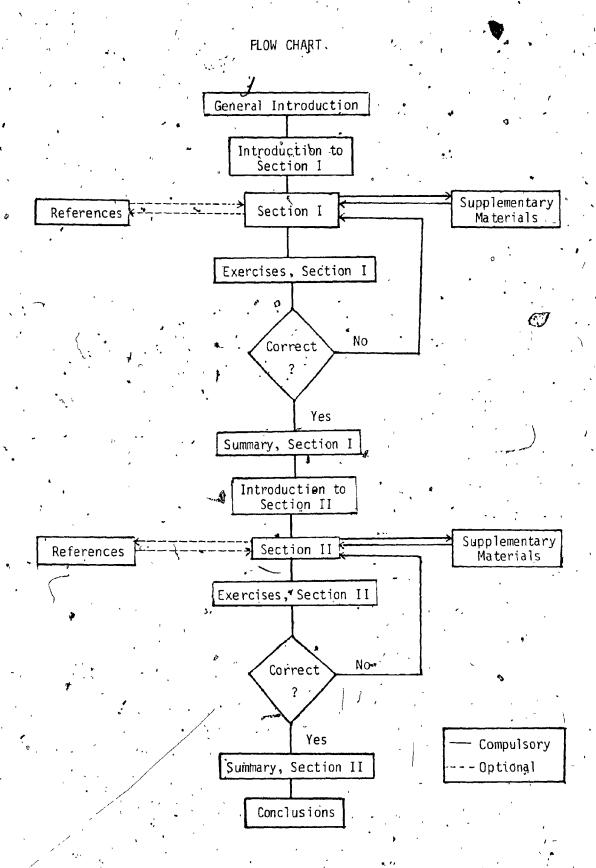
learning. Look at the answer only when you finish writing your own answer. When you see the X's, cover the answer with the sheet of paper. Then, formulate your own answer, write it down, and if necessary -- consult the supplementary materials related to that particular question. Once you have written the answer, you can withdraw the sheet of paper and compare your answer with the answer in th package.

The examples are always boxed to help you locate them easily.

A sectional summary as well as a general summary follows after each section and at the end of the package respectively. The purpose of this section is to help you remember the basic points discussed in each section in particular and in the package, in general. A flow chart follows containing graphic suggestions about the steps to follow while studying the package. If you do not understand something, remember that your adviser is always around to help.

After studying the package, you will be asked to return the package together with the responses.

Good Luck!

FLOW CHART.

Flow chart with boxes:

General Introduction → Introduction to Section I → Section I (with References [optional, dashed] and Supplementary Materials) → Exercises, Section I → Correct? (No → Supplementary Materials; Yes) → Summary, Section I → Introduction to Section II → Section II (with References [optional, dashed] and Supplementary Materials) → Exercises, Section II → Correct? (No → Supplementary Materials; Yes) → Summary, Section II → Conclusions

Legend:
— Compulsory
--- Optional

APPENDIX B

Test

Scientific Method

Name _____   Age _____

Sex _____   Program _____

The prupose of this test is to determine how much knowledge you have about the Scientific Method. Try your best to answer the questions.

GOOD LUCK

1. Mention 3 methods to obtain knowledge..   (3 points)

   1)
   2)
   3)

2. Give 2 examples of common sense knowledge.   (2 points)

   1)
   2)

3. Write down 2 differences between common sense knowledge and scientific knowledge.   (2 points)

   1)
   2)

4. Which are the 2 main sub-activities involved in a research activity's statement of the problem?   (2 points)

   1)
   2)

5. Write down 2 basic differences between formal sciences and
   factual sciences.   (2 points)

   1)
   2)

6. Identify the research steps involved in the Scientific Method.
                                                         (4 points)

7. What is the relationship between Scientific Method and scientific
   research? How is the scientific method different from scientific
   research?   (2 points)

8. From the following list, identify the formal sciences and the
   factual sciences by writing the word formal or factual on the
   on the line opposite the word.   (2 points)

   Chemistry   _____

   Mathematics _____

   Psychology   _____

   Biology   _____

   Sociology   _____

   Logics   _____

After carefully reading the following statements, write T if you think the sentence is true or F if you think it is false. If you think it is false, please replace the underlined word with the correct answer. Write the correct answer on the line below.

1. Technology tries to obtain new knowledge

   just for the sake of knowing.   _____

2. Factual sciences need experimentation to

   determine whether or not their hypotheses are

   acceptable.   _____

3. Variables are predictions the researcher makes

   about the research results.   _____

4. In descriptive research, the researcher

   manipulates a particular factor to determine

   if this manipulation generates any change.   _____

5. Psychology is a nomotetic social science.

   _____   _____

6. The dependent variable is the factor under

   study which the researcher manipulates to

   find out how it affects a phenomenon.   _____

Try to relate the two columns by writing the corresponding
number in the right column on the line close to the left column.

(10 points)

_____ Process employed to solve a
group of problems.

(1) Variable

_____ Body of knowledge gained through
systematic study, based on facts
and principles.

(2) Knowledge

_____ Systematic activity directed to
the discovery and development
of an organized body of knowledge.

(3) Method

_____ Researcher's prediction about the
results which will be obtained
from the research.

(4) Deduction

_____ Reasoning used in science which
employs logic that moves from
specific to general.

(5) Technology

_____ It is a kind of science that gives
us information about something
real and works with facts, since
it has to be observed and/or
experimented on to confirm their
conjectures.

(6) Research

(7) Hypothesis

_____ Application of science to practical
ends.

(8) Factual science

_____ Reasoning used in science which
employs logic that moves from
general to specific.

(9) Induction

_____ It is the intuitive process by which
the experimenter derives a descriptive
statement from the data; it is the
explanation of the results.

(10) Science

(11) Inference

Mark the correct option with an X.

1. These are the conditions or characteristics that the researcher manipulates, observes or controls to determine their effect on a certain phenomenon.

   a) hypotheses

   b) problems

   c) variables

   d) data

2. According to Piaget, which among the social sciences are those that require quantitative relationship and the tendency to use experimental research methods?

   a) historic sciences

   b) nomotetic sciences

   c) legal sciences

   d) philosophic sciences

Test   Método Científico

Nombre _____ : Edad _____

Sexo _____   Carrera _____

Este examen tiene por objeto determinar tus conocimientos sobre el Método Científico, trata de contestarlo mejor que puedas.

BUENA SUERTE

1. Menciona 3 métodos para obtener conocimientos.   (3 puntos)

    1)
    2)
    3)

2. Escribe 2 ejemplos de conocimiento de sentido común.   (2 puntos)

    1)
    2)

3. Escribe 2 diferencias entre conocimiento de sentido común y conocimiento científico.   (2 puntos)

    1)
    2)

4. ¿Cuáles son las 2 sub-actividades principales en el establecimiento del problema de la investigación ?   (2 puntos)

    1)
    2)

5. Escribe 2 diferencias básicas entre ciencias formales y ciencias fácticas.   (2 puntos)

    1)
    2)

6. Enumera los pasos o etapas del Método Científico.

(4 puntos)

7. ¿Qué diferencia existe entre Método Científico e Investigación Científica ?

(2 puntos)

8. Identifica las ciencias formales y las fácticas de la siguiente lista, escribiendo la palabra formal o fáctica en la linea de la derecha.

(2 puntos)

Química   _____

Matemáticas _____

Psicología _____

Biología _____

Sociología _____

Lógica _____

Después de leer cuidadosamente las siguientes afirmaciones;
escribe en la linea de la derecha una V si crees que es verdadera
y una F si crees que es falsa. En el caso de que creas que es fal-
sa, cambia la palabra que esté subrayada por la correcta.

(6 puntos)

1. La Tecnología se ocupa de obtener conocimientos por el

   hecho de conocer más.   _____

2. Las ciencias fácticas necesitan de la experimentación

   para comprobar sus conjeturas.   _____

3. Las variables son predicciones del investigador

   sobre los resultados de la investigación.   _____

4. En la investigación descriptiva el investigador ma-

   nipula un factor particular para comprobar si la

   manipulación genera algún cambio.   _____

5. La Psicología es una ciencia social nomotética.   _____

6. La variable dependiente es el fenómeno que se está

   estudiando y que el investigador manipula para

   ver cuál es su efecto.   _____

Trata de relacionar las dos columnas escribiendo el número correspondiente de la columna de la derecha en la línea de la columna izquierda.

(10 puntos)

_____ Procedimiento para tratar un conjunto de problemas.

(1) Variable

_____ Cuerpo de conocimientos basado en hechos y principios, obtenido a través de estudio sistemático.

(2) Conocimiento

_____ Actividad sistemática dirigida al descubrimiento y desarrollo de un cuerpo de conocimientos organizado.

(3) Método

(4) Deducción

_____ Predicción del investigador sobre los resultados que se obtendran de la investigación.

(5) Tecnología

_____ Razonamiento usado en la ciencia que va de lo particular a lo general.

_____ Nos da información sobre algo real, se ocupa de los hechos y necesita de la experimentación para confirmar sus conjeturas.

(6) Investigación

(7) Hipótesis

_____ Aplicación de la ciencia para fines prácticos.

_____ Razonamiento usado en la ciencia que va de lo general a lo particular.

(8) Ciencia Fáctica

_____ Proceso intuitivo por el cual el experimentador deriva una explicación de los resultados de la investigación.

(9) Inducción

(10) Ciencia

(11) Inferencia

Señala con una X la opción correcta.

(1 punto cada una)

1. Son las condiciones o características que el investigador mani-
   pula, observa o controla.

   a) hipótesis

   b) problemas

   c) variables

   c) datos

2. De acuerdo con Piaget ¿cuáles son entre las ciencias sociales
   las que se distinguen por el uso de relaciones cuantitativas y
   la tendencia a usar métodos de investigación experimental ?

   a) ciencias históricas

   b) ciencias nomotéticas

   c) ciencias legales

   d) ciencias filosóficas

APPENDIX C

Learning Style Questionnaire

Name _____ Program _____

Instructions - Please answer the following questions by placing the letter of the appropriate alternative in the blank to the left of the question number.

_____ 1. Which best describes your main objective of this course?

a) to learn more about Scientific Method

b) to get a good mark that could improve my average

c) to follow a necessary step in my program

d) other (please specify) _____

_____ 2. Why do you work on your assignments for your course?

a) to learn more

b) to obtain extra points

c) because it is compulsory

d) other (please specify) _____

_____ 3. How could your teacher help you best to achieve your objectives?

a) by allowing you to work at your own pace and advising you

b) by organizing team work in the classroom

c) by lecturing in the classroom

d) other (please specify) _____

_____ 4. How important is it to you to consult the teacher while studying?

    a) I like to consult the teacher frequently

    b) I like to consult the teacher once in a while

    c) I prefer not to consult the teacher

_____ 5. Under which of the following circumstances do you learn best?

    a) when I study by myself

    b) when I study with a classmate

    c) when I study with a team

_____ 6. What motivates you to study?

    a) I motivate myself

    b) seeing others studying

    c) the pressure of deadline

_____ 7. Which one of the following best describes your manner of studying?

    a) I study regularly during the semester

    b) I study infrequently for long intervals

    c) I study when I feel the pressure of deadline

_____ 8. How often do you finish the projects that you start?

    a) I always finish what I start

    b) I usually finish what I start

    c) it is hard for me to finish what I start

9. Which of the following ways of perceiving information helps you retain it better?

    a) I can remember information better if I see it

    b) I can remember information better if I hear it

    c) I can remember information better if I apply it

10. How do you prefer to obtain the news?

    a) by reading the newspaper

    b) through the television

    c) by listening to the radio

11. How do you prefer to receive instructions related to something that you have to do?

    a) I prefer written instructions

    b) I prefer oral instructions

    c) I prefer a combination of both

12. How can you better recall a telephone number?

    a) I need to write it down once I hear it

    b) I can remember it once I hear it

    c) I need to dial the number many times to learn it

13. What kind of structure do you need to study most effectively?

    a) I need a clearly structured program that includes well defined activities and references

    b) I need a general guide

    c) I prefer to organize the structure by myself

_____ 14. How do you organize your schedule for studying?

    a) I prefer to study for short periods and then to rest before continuing

    b) I prefer to study long hours without stopping

    c) I do not have any preference as regards my study schedule

_____ 15. Assuming you had control over your study schedule, at what time of the day do you prefer to study?

    a) I prefer to study in the morning

    b) I prefer to study in the afternoon

    c) I prefer to study at night

    c) I have no definite preference for a particular time of day

_____ 16. What kind of background sounds enable you to concentrate while you are studying?

    a) absolute quiet

    b) soft music (records, tapes, radio, etc.)

    c) television

    d) it really doesn't matter

_____ 17. To what extent does the temperature of the room affect your concentration?

    a) I can study better when it is cool

    b) I can study better in a warm environment

    c) the temperature doesn't really affect me

_____ 18. How much do you need to move around while studying?

    a) I like to change position (stand up, walk and come back, etc.) very often while studying

    b) I like to sit for a long time while studying

    c) the position is not really important while I am studying

_____ 19. How important is lighting when you are studying?

    a) I need a specific kind of light that gives a certain brightness

    b) it is not an important factor for me while I am studying

_____ 20. What kind of location do you prefer to study?

    a) in an informal place (at home, the park, etc.)

    b) in a formal place (library, classroom, etc.)

    c) I do not have any preference for a location

_____ 21. Do you eat or drink something while studying?

    a) yes, I always do

    b) sometimes I do

    c) I never do

Scoring Procedure for the Learning Style Questionnaire

Essential Characteristics

Motivation

1. a) 4 points
    b) 2 points
    c) 1 point
    d) 1 point

2. a) 4 points
    b) 2 points
    c) 1 point
    d) 1 point

Need to work at their own and tutorial assistance

3. a) 4 points
    b) 2 points
    c) 1 point
    d) 1 point

4. a) 4 points
    b) 3 points
    c) 1 point

Need to work alone

5. a) 4 points
    b) 2 points
    c) 1 point

Responsibility

6. a) 4 points
    b) 2 points
    c) 1 point

7. a) 4 points
    b) 2 points
    c) 1 point

Persistence

8. a) 4 points
    b) 3 points
    c) 1 point

Visual Orientation and Preference for Reading

9. a) 4 points
    b) 2 points
    c) 1 point

10. a) 4 points
    b) 2 points
    c) 1 point

11. a) 4 points
    b) 2 points
    c) 1 point

12. a) 4 points
    b) 2 points
    c) 1 point

Need for structure

13. a) 4 points   14. a) 4 points
     b) 2 points   b) 4 points
     c) 1 point   c) 1 point

Secondary Characteristics

Need for Specific time of the day

15. a) 3 points
     b) 3 points
     c) 3 points
     d) 1 point

Sound

16. a) 3 points
     b) 1 point
     c) 1 point
     d) 1 point

Temperature   Mobility

17. a) 3 points   18. a) 3 points
     b) 3 points   b) 2 points
     c) 1 point   c) 1 point

Light

19. a) 3 points
     b) 1 point

Design

20. a) 3 points
     b) 3 points
     c) 1 point

Intake

21.   a)   3 points
      b)   2 points
      c)   1 point

77 -67 points = First group - Students who would strongly prefer studying using a print self.- instructional package.

66 -56 points = Second group -   Students who can study using a print self - instructional package, but who would also prefer to receive the information through another teaching method.

55 points or less = Third group - Students who would strongly dislike using a self - instructional package, preferring instead to receive the information from other kinds of teaching instruments.

APPENDIX C

CUESTIONARIO PARA EL "ESTILO DE APRENDIZAJE"

Nombre _____ Carrera _____

INSTRUCCIONES: Por favor contesta las siguientes preguntas con sin-
ceridad. Lee con cuidado cada una de las preguntas y
elige la alternativa que vaya mas de acuerdo con tu
estilo para aprender. Selecciona la letra correspon-
diente y escríbela sobre la linea situada a la iz-
quierda del número correspondiente a cada pregunta.

_____ 1. ¿Cuál es la principal razón que tienes para tomar este
curso ?

a) Aprender mas acerca del método científico

b) Obtener una buena calificación que me ayude en mi pro-
medio.

c) Cumplir un paso necesario en mi carrera.

d) Otra (especifica) _____

_____ 2. ¿Por qué haces, en general los trabajos para tus cursos ?

a) Para aprender más.

b) Para obtener puntos extra.

c) Porque son obligatorios.

d) Otra (especifica) _____

_____ 3. ¿ De qué manera podría ayudarte mejor tu maestro ?

a) Permitiéndote trabajar a tu propio ritmo y asesorándote.

b) Organizando trabajo en equipos en el salón de clases.

c) Dando clase tradicionalmente.

d) Otra (especifica) _____

_____ 4. ¿ Qué tan importante es para tí consultar al maestro cuando estudias ?

a) Me gusta consultar al maestro frecuentemente.

b) Me gusta consultar al maestro de vez en cuando.

c) Prefiero no consultar al maestro.

_____ 5. ¿ En qué circunstancias aprendes mejor ?

a) Cuando estudio solo.

b) Cuando estudio con un compañero

c) Cuando estudio en equipo.

_____ 6. ¿ Qué te motiva para estudiar ?

a) Yo mismo me motivo.

b) Cuando veo a otros que comienzan a estudiar.

c) La presión de un examen.

_____ 7. ¿ Como organizas tus estudios generalmente ?

a) Estudio regularmente durante el semestre.

b) Estudio irregularmente por largos períodos.

c) Estudio cuando voy a tener un examen.

8. ¿ Qué tan seguido terminas los proyectos que comienzas ?

    a)   Siempre termino lo que empiezo.

    b)   Casi siempre termino lo que empiezo.

    c)   Me cuesta mucho terminar lo que empiezo.

9. ¿ Cuál de las siguientes maneras de recibir información te ayuda a retenerla mejor ?

    a)   Puedo recordar mejor la información si la veo.

    b)   Puedo recordar mejor la información si la oigo.

    c)   Puedo recordar mejor la información si la aplico.

10. ¿ Cómo prefieres enterarte de las noticias ?

    a)   Leyendo el periódico..

    b)   Por medio de la televisión.

    c)   Escuchando el radio.

11. ¿ Cómo prefieres recibir las instrucciones sobre algo que tienes que hacer ?

    a)   Prefiero instrucciones por escrito.

    b)   Prefiero instrucciones habladas

    c)   Prefiero una combinación de ambas.

12. ¿ Cómo aprendes mejor un número de teléfono ?

    a)   Necesito escribir el número en el momento en que lo escucho.

    b)   Puedo recordar el número una vez que lo escucho.

    c)   Necesito marcar el número varias veces para aprenderlo.

13. ¿ Qué clase de estructura necesitas para estudiar más efectivamente ?

   a) Necesito un programa claramente estructurado, incluyendo actividades muy bien definidas y referencias.

   b) Necesito solamente una guía general.

   c) Prefiero organizar yo mismo la estructura.

14. ¿ Cómo organizas tu horario para estudiar ?

   a) Prefiero estudiar por períodos cortos y descansar entre uno y otro período.

   b) Prefiero estudiar por horas sin descansar.

   c) No tengo ninguna preferencia relacionada con mi horario de estudio.

15. Si pudieras tener control en tu horario de estudio ¿ qué hora del dia preferirías ?

   a) Prefiero estudiar en las mañanas.

   b) Prefiero estudiar en las tardes.

   c) Prefiero estudiar en las noches.

   d) No tengo preferencia definida.

16. ¿ Como prefieres el ambiente en cuanto a ruido cuando estudias ?

   a) Completamente silencio.

   b) Con música suave (discos, cassettes, radio, etc.)

   c) Televisión

   d) No me afecta ningun tipo de ruido.

17. ¿ Qué tanto te afecta la temperatura en tu concentración ?

    a) Puedo estudiar mejor en un ambiente fresco.

    b) Prefiero un ambiente tibio.

    c) La temperatura no afecta mi concentración.

18. ¿ Qué tan seguido te gusta cambiar de postura cuando estudias ?

    a) Me gusta cambiar de postura (levantarme, caminar, volverme a sentar, etc.) muy seguido.

    b) Me gusta quedarme sentado durante horas.

    c) La posición no es un factor muy importante para mí cuando estudio.

19. ¿ Qué tan importante es para tí la luz cuando estudias ?

    a) Necesito determinado tipo e intensidad de luz.

    b) No es un factor importante para mí cuando estudio.

20. ¿ Dónde prefieres estudiar ?

    a) En un lugar informal (casa, parque, etc.)

    b) En un lugar formal (biblioteca, salón de clases, etc.)

    c) No tengo preferencia por un lugar para estudiar.

21. ¿ Es importante para tí comer o beber algo mientras estudias ?

    a) Sí, siempre lo hago.

    b) Algunas veces lo hago.

    c) No, nunca lo hago.

APPENDIX D

Evaluation form to evaluate the self - instructional
package in scientific method

Name _____   Program _____

Instructions: Please indicate your response by circling the appropriate
alternative.

Objectives

1. The objectives of   The objectives of the
    the package were   package were very
    not clear.   1   2   3   4   5   clearly defined.

Content

2. The content of the   There was a very close
    package was poorly   relationship between
    related to the   content and objectives.
    objectives.   1   2   3   4   5

Organization

3. The organization   The organization of
    of the package was   the package was
    very clear.   1   2   3   4   5   confusing.

Presentation

4. The presentation of   The presentation of
    the package was   the package was
    interesting.   1   2   3   4   5   boring.

Motivation

5. The package was   The package was
    not motivating.   1   2   3   4   5   extremely motivating.

Instructions

6. The instructions   The instructions
    explaining how to   explaining how to
    work with the package   work with the package
    were clear.   1   2   3   4   5   were confusing.

Vocabulary

7. The vocabulary
   used in the package
   was confusing.   1   2   3   4   5   The vocabulary used
                                                in the package was
                                                clear.

Exercises

8. The exercises
   were very helpful.   1   2   3   4   5   The exercises were
                                                not at all helpful.

Supplementary Materials

9. The supplementary
   materials were not
   at all helpful.   1   2   3   4   5   The supplementary
                                                materials were very
                                                helpful.

Overall value of the package

10. Very good   1   2   3   4   5   Of no value

11. Which part did you find most valuable? _____

_____

Why? _____

_____

12. Which part did you find least valuable? _____

_____

Why? _____

_____

13. Would you like to study again using a self - instructional package?

        Yes   No

Why? _____

_____

APPENDIX D

EVALUACION DEL PAQUETE AUTO - INSTRUCTIVO EN

METODO CIENTIFICO

Nombre _____   Carrera _____

INSTRUCCIONES: Después de haber estudiado el paquete auto-instructivo,

por favor expresa tus opiniones encerrando en un círculo

el número que creas conveniente.

Objetivos

1. Los objetivos de la lección no son nada claros.   1   2   3   4   5   Los objetivos son claramente esta-blecidos.

Contenido

2. El contenido del paquete no está relacionado con los objetivos.   1   2   3   4   5   El contenido está estrechamente rela-cionado con los objetivos.

Organizacion

3. El contenido del paquete está muy bien organizado y claro.   1   2   3   4   5   El contenido del paquete es confuso y desordenado.

Presentacion

4. La presentación del paquete es interesante.   1   2   3   4   5   La presentación del paquete es aburri-da.

Motivacion

5. La lección es muy motivante.   1   2   3   4   5   La lección no es na-da motivante.

Instrucciones

6. Las instruccio-   Las instrucciones
nes sobre como   sobre como estu-
estudiar el pa-   diar el paquete
quete son muy   son confusas.
claras.   1   2   3   4   5

Vocabulario

7. El vocabulario   El vocabulario usa-
usado en el pa-   do en el paquete es
quete es confu-   muy claro.
so.   1   2   3   4   5

Ejercicios

8. Los ejercicios   Los ejercicios del
del paquete son   paquete no son
muy útiles para   útiles.
aprender.   1   2   3   4   5

Material Complementario

9. El material com-   El material comple-
plementario no   mentario es muy
resulta util pa-   util para el paque-
ra el paquete.   1   2   3   4   5   te.

Valor de la lección en general

10. Muy buena.   1   2   3   4   5   Muy mala

11. ¿ Cuál te parece la mejor parte del paquete ? _____

   _____

   ¿ Por qué ? _____

12. ¿ Cuál te parece la parte de menos valor ? _____

   _____

   ¿ Por qué ? _____

13. ¿ Te gustaría volver a estudiar usando un paquete de auto-
    instrucción ?

       Si   No

    ¿ Por qué ? _____