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ABSTRACT

The instruments used in the evaluation of Project C-BE (computer-based instruction) are presented and described in this report. A brief description of each instrument, its purpose, developmental history, references and reliability studies are provided. These instruments were administered to Project C-BE classes in an attempt to identify psychological variables which could be used to predict performance in various computer-based instruction settings. These variables included personal tendencies revealed by the Bass Orientation Inventory (ORI) and preferences in college indicated by the Orientation Toward College Inventory (OTC). Preferences in learning and activity settings were assessed with the Learning Style Inventory (LSI). Familiarity with computer technology and nomenclature was tested with the Computer Sophistication Questionnaire (CSQ). Student attitudes toward the course and toward computer based instruction were assessed with pretest and posttest questionnaires so that changes in attitudes due to exposure to computer-based education could also be measured. (Author/CH)

C-BE EVALUATION INSTRUMENTS:

A DESCRIPTIVE REPORT

EP-35/8/13/75

Sheila Reifle and Agnes Edwards

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C-BE EVALUATION INSTRUMENTS:

A DESCRIPTIVE REPORT

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ABSTRACT

The instruments used in the evaluation of PROJECT C-BE are presented and described. Following the SCRAPE Model (EP-4), these instruments were administered to PROJECT C-BE classes in an attempt to identify psychological variables which could be used to predict performance in various computer-based instructional settings. These variables included personal tendencies and preferences ("response sets") in college, learning, and activity settings. Familiarity with computer technology and nomenclature was also tested. Student attitudes toward the course and toward computer-based instruction were assessed with pretest and posttest questionnaires so that changes in attitudes due to exposure to computer-based education could also be measured.

INTRODUCTION

PROJECT C-BE was a coordinated four-year research effort conducted by The University of Texas at Austin with joint funding by the National Science Foundation and the University. It began in the Fall of 1971 under University funding, reached its peak developmental activities during 1973 and 1974, and will be effectively terminated August 31, 1975. The primary purpose of the research effort was to evaluate pedagogical computer applications that were intended to foster improvement in undergraduate instruction in the sciences and engineering on an interdisciplinary basis. The project was not a specialized hardware or software curriculum development effort, but rather a much broader study effort that introduced new concepts in computer teaching techniques and provided useful technology in education to the administration, faculty, staff and students. In addition to assessing the effectiveness of computer-based techniques in education, the project also hoped to study the process by which those techniques are developed and evaluated so the future user could "naturally" incorporate information processing methods into their courses.

This report will give a brief overview of the evaluation instruments used by PROJECT C-BE. It will give a brief description, state their purpose, their developmental history, and list references and reliability studies. The following instruments are included in this report:

1. Bass Orientation Inventory (ORI)
2. Learning Style Inventory (LSI)
3. Orientation toward College Inventory (OTC)
4. Computer Sophistication Questionnaire (CSQ)
5. Attitude Questionnaires

The Orientation Inventory (ORI)

The Orientation Inventory (ORI)

The Orientation Inventory is applicable to situations in which effective work performance may related to an individual's attitude toward completing tasks or solving problems. In the C-BE setting, it was supposed that scores on ORI scales might be related to success with computer-based instruction.

The ORI is composed of three ipsative scales:

a. The self-orientation scale reflects the degree to which an individual describes himself as expecting or preferring direct personal rewards for his work. A high-scorer on this scale may be unresponsive to others in a group situation.

b. The interaction-orientation scale indicates the extent of a person's concern with participating in and maintaining pleasurable, harmonious relationships with others.

c. The task-orientation scale reflects the degree to which an individual is concerned about completing an assignment or solving a problem, with diligence.

The inventory consists of twenty-seven statements or questions with three possible response choices, from which a person chooses the most and least preferred. The resulting scores on each of the scales should always sum to eighty-one; thus the scores are "ipsative", interdependent.

The test-retest reliability estimates were obtained on each scale from eighty-four college students (see reference):

(1)	Self Scale	.73
(2)	Interaction Scale	.76
(3)	Task Scale	.75

When scale classifications for pretest and posttest administrations were compared, 6.5% of the students changed from one classification to another. Several studies have been made of both concurrent and construct validity of the ORI. Although most of them were in industrial settings, college populations have also been used.

Reference

Bass, B.M., The orientation inventory (Manual). Palo Alto, California: Consulting Psychologists Press, Inc., 1962.

BEGIN HERE

1. One of the greatest satisfactions in life is:
   A Recognition for your efforts.
   B The feeling of a job well done.
   C The fun of being with friends.

2. If I played football, I would like to be:
   A The coach whose planning pays off in victory.
   B The star quarterback.
   C Elected captain of the team.

3. The best instructors are those who:
   A Give you individual help and seem interested in you.
   B Make a field of study interesting, so you will want to know more about it.
   C Make the class a friendly group where you feel free to express an opinion.

4. Students downgrade instructors who:
   A Are sarcastic and seem to take a dislike to certain people.
   B Make everyone compete with each other.
   C Simply can't get an idea across and don't seem interested in their subject.

5. I like my friends to:
   A Want to help others whenever possible.
   B Be loyal at all times.
   C Be intelligent and interested in a number of things.

6. My best friends:
   A Are easy to get along with.
   B Know more than I do.
   C Are loyal to me.

7. I would like to be known as:
   A A successful person.
   B An efficient person.
   C A friendly person

8. If I had my choice, I would like to be:
   A A research scientist.
   B A good salesman.
   C A test pilot.

9. As a youngster I enjoyed:
   A Just being with the gang.
   B The feeling of accomplishment I had after I did something well.
   C Being praised for some achievement.

10. Schools could do a better job if they:
    A Taught children to follow through on a job.
    B Encouraged independence and ability in children.
    C Put less emphasis on competition and more on getting along with others.

11. The trouble with organizations like the Army or Navy is:
    A The rank system is undemocratic.
    B The individual gets lost in the organization.
    C You can never get anything done with all the red tape.

12. If I had more time, I would like to:
    A Make more friends.
    B Work at my hobby or learning something new and interesting.
    C Just take it easy, without any pressure.

13. I think I do my best when:
    A I work with a group of people who are congenial.
    B I have a job that is in my line.
    C My efforts are rewarded.

Open this flap and continue with question 14.

The ORIENTATION INVENTORY

by

Bernard M. Bass, Ph. D.

DIRECTIONS

This test consists of 27 statements of opinions and attitudes. For each statement please indicate in the answer blocks which of the three alternatives, A, B, or C, is *most* true, or *most* preferred, or *most* important to you by writing A, B, or C in the *MOST* column.

Then choose the *least* true or *least* preferred of the three alternatives and write its letter in the *LEAST* column.

For every statement, be sure you mark one alternative in each column. If A is entered under *Most*, then either B or C should be marked under *Least*, and so on.

Do not debate too long over any one statement; your first reaction is desired.

TURN THE SHEET OVER AND BEGIN

(Do not unfold)

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Palo Alto, California

MOST	LEAST	MOST	LEAST	
☐	☐	☐	☐	14. I like: A Being appreciated by others. B Being satisfied personally with my performance. C Being with friends with whom I can have a good time.
☐	☐	☐	☐	15. I would like to see a story about myself in the newspaper: A Describing a project I had completed. B Citing the value of my actions. C Announcing my election to a fraternal organization.
☐	☐	☐	☐	16. I learn best when my instructor: A Provides me with individual attention. B Stimulates me into working harder by arousing my curiosity. C Makes it easy to discuss matters with him and with others.
☐	☐	☐	☐	17. Nothing is worse than: A Having your self-esteem damaged. B Failure on an important task. C Losing your friends.
☐	☐	☐	☐	18. I like: A Personal praise. B Cooperative effort. C Wisdom.
☐	☐	☐	☐	19. I am considerably disturbed by: A Hostile arguments. B Rigidity and refusal to see the value of new ways. C Persons who degrade themselves.
☐	☐	☐	☐	20. I would like to: A Be accepted as a friend by others. B Help others complete a mutual task. C Be admired by others.
☐	☐	☐	☐	21. I like a leader who: A Gets the job done. B Makes himself respected by his followers. C Makes himself easy to talk to.
☐	☐	☐	☐	22. I would like to: A Have a committee meeting to decide what the problem is. B Work out by myself the correct solution to the problem. C Be valued by my boss.
☐	☐	☐	☐	23. Which type of book would you like to read? A A book on getting along with people. B An historical romance. C A how-to-do-it book.
☐	☐	☐	☐	24. Which would you prefer? A Teach pupils how to play the violin. B Play violin solos in concerts. C Write violin concertos.
☐	☐	☐	☐	25. Which leisure time activity is satisfying to you? A Watching westerns on TV. B Chatting with acquaintances. C Keeping busy with interesting hobbies.
☐	☐	☐	☐	26. Which would you prefer, assuming the same amount of money was involved? A Plan a successful contest. B Win a contest. C Advertise the contest and get others to participate.
☐	☐	☐	☐	27. Which is important to you? A To know what you want to do. B To know how to do what you want. C To know how to help others to do what they want.

Be sure to write your name and supply the other information requested in the space provided above.

Name (Please Print):

_____
Last

_____
First *Initial*

_____ *Circle Sex:* M F
Age

6 7 8 9 10 11 12 13 14 15 16
Circle Highest School Grade Completed

Current Job:

_____
(If a student, major field of study)

(DO NOT WRITE BELOW THIS LINE)

	M	L				
g	____	− ____	= ____	+ 27	=	____
i	____	− ____	= ____	+ 27	=	____
t	____	− ____	= ____	+ 27	=	____

Standard Scores or Percentiles:
(Circle One)

g _____
i _____
t _____

Learning Style Inventory (LSI)

Learning Style Inventory (LSI)

Designed to assess methods of learning, the Learning Style Inventory consists of nine sets of four adjectives. For each set, the subject ranks the adjectives according to which best describes his learning style. Four dimensions of learning styles are measured:

a. Concrete experience (CE) consists of use of observations, feelings, and reactions.

b. Reflective observation (RO) emphasizes detached, tentative observation and reflection.

c. Abstraction conceptualization (AC) is concerned with forming concepts and generalizations by evaluating and analyzing.

d. Active experimentation (AE) is applying concepts to new situations.

It was thought that individuals with a certain predominant learning style, such as active experimentation, might gain more benefit from the computer-based situation than those with some other learning style, such as reflective observation.

Test-retest reliability data was gathered for seventeen students in the fall of 1973. The correlations for the four scales were too low to be useful. Also, the LSI did not discriminate among groups of students, and its use was discontinued.

The test-retest reliability estimates were:

CE Scale	.50
RO Scale	.63
AC Scale	.13
AE Scale	.25

References

Kolb, D.A., Rubin, I.M., and McIntyre, J.M. Organizational psychology: An experimental approach. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971.

LEARNING STYLE INVENTORY

This inventory is designed to assess your method of learning. As you take the inventory, give a high rank to those words which best characterize the way you learn and a low rank to the words which are least characteristic of your learning style.

You may find it hard to choose the words that best describe your learning style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to describe how you learn, not to evaluate your learning ability.

Instructions

There are nine sets of four words listed below. Rank order each set of four words assigning a 4 to the word which best characterizes your learning style, a 3 to the word which next best characterizes your learning style, a 2 to the next most characteristic word, and a 1 to the word which is least characteristic of you as a learner. Be sure to assign a different rank number to each of the four words in each set. Do not make ties.

1.	____discriminating	____tentative	____involved	____practical
2.	____receptive	____relevant	____analytical	____impartial
3.	____feeling	____watching	____thinking	____doing
4.	____accepting	____risk-taker	____evaluative	____aware
5.	____intuitive	____productive	____logical	____questioning
6.	____abstract	____observing	____concrete	____active
7.	____present-oriented	____reflecting	____future-oriented	____pragmatic
8.	____experience	____observation	____conceptualization	____experimentatio
9.	____intense	____reserved	____rational	____responsible

FOR SCORING ONLY

CE____ ____ RO____ AC____ AE____

23[illegible]78 136789 234589 136789

The Orientation toward College Inventory (OTC)

The Orientation toward College Inventory (OTC)

The Orientation toward College Inventory was used to see if it could discriminiate among groups of students with respect to performance in computer-based instruction. The OTC consists of four paragraphs which describe four different personal philosophies about the purposes of higher education. Students were asked to indicate their degree of agreement with a paragraph on a five-point scale.

a. The vocational philosophy emphasizes career preparation as a purpose of higher education.
b. The academic philosophy stresses intellectual and scholastic development.
c. The social philosophy holds extracurricular and social activities are of primary importance.
d. The identity-seeking philosophy is most concerned with the importance of individualism and personal meaning in life.

The four paragraphs were supposed to describe the values represented by four collegiate subcultures identified by Trow and Clark.

A test-retest reliability study was conducted with twenty-five undergraduates. The Pearson reliability coefficients ranged from r = .44 for the vocational philosophy to r = .75 for the social philosophy.

References

Peterson, R.E. On a typology of college students. Princeton, N.J.: Educational Testing Service, 1965, Research Bulletin RB-65-9.

Trow, M., and Clark, B.R., Varieties and determinants of undergraduate subcultures. Paper presented at the annual meeting of the American Sociological Association, New York, 1960.

NAME_____ AREA OR PROGRAM SPECIALIZATION: _____

ORIENTATION TOWARD COLLEGE

Directions: On every college or university campus, students hold a variety of attitudes about their own purposes and goals while at college. Such an attitude might be thought of as a personal philosophy of higher education. Below are descriptive statements of four such "personal philosophies" which there is reason to believe are quite prevalent on American college campuses. As you read the four statements, attempt to determine how close each comes to your own philosophy of higher education.

_____PHILOSOPHY A: This philosophy emphasizes education essentially as preparation for an occupational future. Social or purely intellectual phases of campus life are relatively less important, though certainly not ignored. Concern with extracurricular activities and college traditions is relatively small. Persons holding this philosophy are usually quite committed to particular fields of study and are in college primarily to obtain training for careers in their chosen fields.

_____PHILOSOPHY B: This philosophy, while it does not ignore career preparation, assigns greatest importance to scholarly pursuit of knowledge and understanding wherever the pursuit may lead. This philosophy entails serious involvement in course work or independent study beyond the minimum required. Social life and organized extracurricular activities are relatively unimportant. Thus, while other aspects of college life are not to be forsaken, this philosophy attaches greatest importance to interest in ideas, pursuit of knowledge, and cultivation of the intellect.

_____PHILOSOPHY C: This philosophy holds that besides occupational training and/or scholarly endeavor, an important part of college life exists outside the classroom, laboratory, and library. Extracurricular activities, living-group functions, athletics, social life, rewarding friendships, and loyalty to college traditions are important elements in one's college experience and necessary to the cultivation of the well-rounded person. Thus, while not excluding academic activities, this philosophy emphasizes the importance of the extracurricular side of college life.

_____PHILOSOPHY D: This is a philosophy held by the student who either consciously rejects commonly held value orientations in favor of his own, or who has not really decided what is to be valued and is, in a sense, searching for meaning in life. There is often deep involvement with ideals and art forms both in the classroom and in sources (often highly original and individualistic) in the wider society. There is little interest in business or professional careers; in fact, there may be a definite rejection of this kind of aspiration. Many facts of the college-organized extracurricular activities, athletics, traditions, the college administration are ignored or viewed with disdain. In short, this philosophy may emphasize individualistic interests and styles, concern for personal identity, and often, contempt for many aspects of organized society.

Now that you have read the philosophies, rank the four according to the accuracy with which each portrays your own point of view. Use numbers from 1-4 with one referring to the most appropriate and four to the least appropriate.

Computer Sophistication Questionnaire (CSQ)

Computer Sophistication Questionnaire (CSQ)

The Computer Sophistication Questionnaire is a multiple-choice test used to assess knowledge about computers at a non-technical, unsophisticated level. It was intended to distinguish those students having a basic understanding of the cabilities and limitations of computer technology from those having very little familiarity with computer technology.

The original seventeen item form of the CSQ was developed by PROJECT C-BE staff. The internal consistency of its items was assessed by administering it to a class of 202 introductory psychology students. Cronbach's alpha coefficient was computed to be .80, indicating good internal consistency. The length of the CSQ was reduced to ten items which were chosen on the basis of face validity and on the basis of biserial correlations with the total test score, which ranged from .21 to .62. The following results from the analyses of data collected during the 1973-74 school year support the validity of the CSQ:

1. A positive relationship between the amount of experience using TAURUS and CSQ scores.
2. A positive relationship between CSQ scores and scores on the SAT-Verbal and the SAT-Math.
3. Some support for a positive relationship between the final grade in the course and CSQ scores.

Rationale and Development

The Computer Sophistication Questionnaire (CSQ) was developed to provide an assessment of the relative amounts of knowledge about computers and computer operation possessed by students enrolled in courses using computer-based instructional materials. The need for such a measure stems from the need to determine to what extent and in what educational settings prior knowledge of computers was a necessary prerequisite to success with computer-based materials.

In many introductory level classes where neither programming skills nor other computer experience is a prerequisite for registration, students who have no previous experience operating a computer terminal are confronted with the necessity of gaining access to the computer and interacting with instructional modules. In situations where the procedure for signing on and interacting with the modules is greatly simplified or where adequate orientation and proctoring is provided for the students, the lack of previous experience may not be a problem. If, however, the information presented to the students is not sufficient to permit them to operate the computer equipment, then the knowledge that students bring to the class may become a significant factor in their capacity to benefit from the computer-based instruction. This factor may be a function of the students' ability to operate the equipment in the absence of adequate orientation or instructions. It may also be the case that knowledge of the computer's operation provides students with a perspective of the difficulties they experience so that they are better able to cope with problems that arise without having their performance adversely affected

by anxiety over their inability to correctly operate the computer equipment.

The Computer Sophistication Questionnaire (CSQ) was designed to assess a relatively non-technical level of knowledge about computers. It was intended to differentiate students who possess a basic understanding of the principles of computer knowledge from those who have little or no grasp of the technology and limitations of computer science. Given this intent no attempt was made to assess detailed knowledge of computers, and the CSQ was not expected to discriminate between individuals with a sophisticated knowledge of computers and those with a detailed practical understanding such as trained programmers. The items focused upon general information about computers that a sophisticated student might be expected to possess; i.e., the value of using computers in an educational setting, the name of the manufacturer of the University of Texas at Austin's research computer, general principles of computer operation, etc. An additional possible use for a test such as the CSQ is as a vehicle for presenting information in an orientation program. If it were determined that some form of introduction to CAI would benefit students, feedback on CSQ results might be used to structure such an orientation program.

The original seventeen-item form was constructed of items which the authors felt tapped the sophisticated layman's level of understanding. An attempt was made to include popular misconceptions as distractor alternatives for several of the items, because the choice of these items would be indicative of a lower level of sophistication, and because the inclusion of the popular misconceptions or cliches would serve as valuable starting points for discussion if the CSQ were to be used as an orientation tool.

The internal consistency of the CSQ was assessed by administering the original seventeen-item form to 202 students enrolled in an introductory psychology class. The mean score for this sample of students was 8.24 and the standard deviation was 3.80. Chronbach's alpha was employed as a measure of consistency and the alpha coefficient of .80 indicated good internal consistency.

A shortened from of the test was developed for large scale administration. The revised form consisted of ten items from the original questionnaire, which seemed at face value to be the most appropriate for the purposes of the test and which had point biserial correlations with total test score ranging from .21 to .62. The percent correct ratios for the ten items in the revised form ranged from a low of .30 to a high of .87.

References

Kevin, R.C. and Liberty, P.G., Jr. Student's personality, attitude, and learning style as predictors of performance in an undergraduate organic chemistry course using computer-based instruction. The University of Texas at Austin: The Measurement and Evaluation Center, 1973a, Research Bulletin RB-73-13 and PROJECT C-BE, EP 18/8/5/75.

Kevin, R.C. and Liberty, P.G., Jr. Student's personality, attitude, and learning style as predictors of performance in five computer-based education courses. The University of Texas at Austin: Measurement and Evaluation Center, 1973b, Research Bulletin RB-73-16.

Kevin, R.C. and Prager, K.J. Student characteristics and performance in two undergraduate chemistry courses employing computer-based instruction. The University of Texas at Austin: Measurement and Evaluation Center, 1974, Research Bulletin RB-74-1.

COMPUTER SOPHISTICATION QUESTIONNAIRE

1973-74 and Fall, 1974

Directions

This questionnaire is designed to determine how much knowledge of computers you bring into your experience with computer-based instruction. Please answer all of the questions to the best of your ability. The concern is with what you already know. Your responses will have no effect upon your course grade.

26. Computers can:

A. do a scientist's thinking for him.
B. add, subtract, and remember.
C. solve problems by intuition.
D. help devise new solutions to old problems.
E. B and D of the above.

27. When asked a question, a computer:

A. always responds correctly.
B. never responds correctly.
C. may invoke the fifth amendment.
D. responds only as a human being has programmed it to respond.
E. none of the above.

28. The difference between a computer and an adding machine is:

A. that a computer can solve problems with human direction.
B. that a computer stores more information than an adding machine.
C. that a computer is faster than an adding machine.
D. A and B of the above.
E. B and C of the above.

29. The two main types of computers in use today are:

A. digital and analog.
B. digital and binary.
C. analog and hydraulic.
D. analog and trasistorized.
E. digital and transistorized.

30. Most modern computers contain:

A. vacuum tubes.
B. transistors.
C. several hundred midget mathematicians.
D. cog wheels.
E. all of the above.

31. Computers are valuable in education:

A. because they understand students better than ordinary teachers.
B. because they can give students more individual attention than would be possible with unaided human teachers.
C. because they think faster than human beings.
D. because they never elope with coeds.
E. in no possible way.

32. To communicate with a computer you may:

A. use English only.
B. use FORTRAN only.
C. use BASIC only.
D. use polite forms of address.
E. use any language which the computer is programmed to accept.

33. The speed of computing (from one step to the next) in modern computers is measured in:

A. tenths of seconds.
B. milliseconds.
C. ten billionths of seconds.
D. googols.
E. nanoseconds.

34. Information can be "read in" to a computer by:

A. punched cards.
B. teletype.
C. magnetic tape.
D. optical scanning apparatus.
E. all of the above.

35. In FORTRAN, a "DO loop" is:

A. a vicious circle.
B. a diagnostic message.
C. a programming operation.
D. the opposite of a "DON'T loop."
E. none of the above.

Thank you for your cooperation. If you have any general comments that you would like to make regarding computer-based instruction or regarding this questionnaire, please make them on the back of the answer sheet.

* * * * * * * * * *

Attitude Questionnaires

Attitude toward Computer-Based Instruction Questionnaires

The attitude questionnaires were used in an attempt to predict a student's final course grade from his attitude scores. Additional information was obtained by administering pretest and posttest versions, so that change in attitudes over the semester could be detected and measures.

The attitude questionnaires have had various forms and revisions, to be described below. The most recent form consisted of pretest and posttest versions containing two scales: Attitude toward Using the Computer (called computer) and Attitude toward the Course (called course). Items belonging to the two scales are intermixed throughout most of the questionnaires. The first part of each questionnaire consists of multiple choice responses to statements, which usually indicate degree of agreement with the statement. The last part is a semantic differential, in which a response indicates degree of preference for either of two opposing adjectives to describe a statement.

The attitude questionnaire used in evaluation studies for the fall, 1972 and spring, 1973 school year was a two-scale semantic differential called Attitude toward Computer-Based Instruction and toward Course Subject Matter Questionnaire. The scales were Attitude toward the Course Subject Matter (or Attitude toward Chemistry) and Attitude toward the Computer as a Study Aid. Each scale consisted of ten pairs of bi-polar adjectives, and the student could indicate his degree of agreement on a seven-point scale. (Kevin and Liberty, 1973a and Kevin and Liberty, 1973b.)

The Attitude toward Computer-Based Instruction Questionnaire was used in the fall, 1973 and spring, 1974 school year. It had different pretest and posttest versions: The pretest had thirty-nine items and the posttest had forty-five. Both versions consisted of multiple-choice statements and

semantic differentials. This questionnaire was developed by PROJECT C-BE staff, primarily Richard Kevin, who selected some items from the previous (1972-73) questionnaire and items from attitude questionnaires used in other computer-in-instruction projects. (Kevin and Prager, 1974)

Factor analyses were performed on pretest and posttest data gathered in the fall of 1973. The items which appeared in both the pretest and posttest, and which composed the first and second factors of the various rotation analysis, were chosen for further analyses involving attitudinal variables. The items belonging to factor I composed the Attitude toward Using the Computer Scale, and the factor II items composed the Attitude toward the Course Scale. (Kevin and Prager, 1974)

The revised Attitude toward Computer-Based Instruction Questionnaire, used in the fall of 1974, was based on the items in the two attitude scales derived by factor analyses. The general format and types of questions were the same as in the previous questionnaire. The pretest consisted of eighteen items, while the posttest had thirty-one.

Reliability estimates were made on those questionnaire items derived by factor analysis. Alpha coefficients for internal consistency were computed for each (pre- and posttest) version of each (course and computer) scale. Ranging from .89 to .94, the alpha values were considered satisfactory.

References

Kevin, R.C. and Liberty, P.G., Jr. Students' personality, attitude, and learning style as predictors of performance in an undergraduate organic chemistry course using computer-based instruction. The University of Texas at Austin: The Measurement and Evaluation Center, 1973a, Research Bulletin RB-73-13 and PROJECT C-BE, EP 18/8/5/75.

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Kevin, R.C. and Prager, K.J. Student characteristics and performance in two undergraduate chemistry courses employing computer-based instruction. The University of Texas at Austin: Measurement and Evaluation Center, 1974, Research Bulletin RB-74-1.

ATTITUDE TOWARD COMPUTER-BASED INSTRUCTION

Pretest, Fall, 1974

For items 8 through 12, please indicate whether you agree or disagree with the sentiment expressed. Use the following code.

A. Agree Strongly

B. Agree Moderately

C. No Opinion

D. Disagree Moderately

E. Disagree Strongly

- - - - - - - - - - -

8. I expect the subject matter of this course to be tedious and boring.

9. I expect that computer-based instruction will make learning more interesting.

10. I am not in favor of computer-based instruction because it is another step in the depersonalization of education.

11. I expect that computer-based instruction will make learning tedious and boring.

12. I expect to enjoy studying the subject matter of this course.

13. In this course I feel that the computer will:

A. Be a valuable tool which will aid me to grasp the course material more readily than would be possible with traditional instruction alone.
B. Be of some aid to me in understanding course material.
C. Make little difference to me in my efforts to learn.
D. Be a possible source of hindrance to my mastery of the material.
E. Definitely make it harder for me to master the concepts presented in the course.

On items 14 through 25, please indicate how you feel about the course subject matter and the computer on the various dimensions marked by the pairs of adjectives or phrases below. If, for example, in item 14, you feel that the course material is very "useless," mark the "E" response. If you consider the course to be slightly "useful," mark the "B" response. Please mark all items.

I feel that the Course Subject Matter will be:

14.	useful	A	B	C	D	E	useless
15.	interesting	A	B	C	D	E	uninteresting
16.	important	A	B	C	D	E	unimportant
17.	helpful to me	A	B	C	D	E	hindering to me

I feel that, in general, the Computer as an Aid to Mastering Subject Matter will be:

18.	useful	A	B	C	D	E	useless
19.	speeds learning	A	B	C	D	E	slows learning
20.	pleasurable to use	A	B	C	D	E	painful to use
21.	helpful to me	A	B	C	D	E	hindering to me
22.	skillful	A	B	C	D	E	bungling
23.	successful	A	B	C	D	E	unsuccessful

24. I feel that the Computer, as a Tool for Classroom Learning will be:

useful	A	B	C	D	E	useless

25. I feel that the Computer, as an Aid to Me in Mastering My Major Field, will be:

useful	A	B	C	D	E	useless

On items 14 through 25, please indicate how you feel about the course subject matter and the computer on the various dimensions marked by the pairs of adjectives or phrases below. If, for example, in item 14, you feel that the course material is very "useless," mark the "E" response. If you consider the course to be slightly "useful," mark the "B" response. Please mark all items.

I feel that the Course Subject Matter will be:

14.	useful	A	B	C	D	E	useless
15.	interesting	A	B	C	D	E	uninteresting
16.	important	A	B	C	D	E	unimportant
17.	helpful to me	A	B	C	D	E	hindering to me

I feel that, in general, the Computer as an Aid to Mastering Subject Matter will be:

18.	useful	A	B	C	D	E	useless
19.	speeds learning	A	B	C	D	E	slows learning
20.	pleasurable to use	A	B	C	D	E	painful to use
21.	helpful to me	A	B	C	D	E	hindering to me
22.	skillful	A	B	C	D	E	bungling
23.	successful	A	B	C	D	E	unsuccessful

24. I feel that the Computer, as a Tool for Classroom Learning will be:

useful	A	B	C	D	E	useless

25. I feel that the Computer, as an Aid to Me in Mastering My Major Field, will be:

useful	A	B	C	D	E	useless

ATTITUDE TOWARD COMPUTER-BASED INSTRUCTION

Posttest, Fall, 1974

For items 1 through 12, please indicate whether you agree or disagree with the sentiment expressed. Use the following code.

A. Agree Strongly

B. Agree Moderately

C. No Opinion

D. Disagree Moderately

E. Disagree Strongly

- - - - - - - - - -

1. Computer-based instruction makes learning more interesting.

2. I am not in favor of computer-based instruction because it is another step in the depersonalization of education.

3. I expected to enjoy studying the subject matter of this course.

4. The computer did so much of the work in the lessons that I didn't learn as much as if I had done all of the computations myself.

5. The use of the computer made it possible for me to concentrate most of my attention on the concepts involved in the lessons without getting bogged down in details.

6. The use of the computer allowed me to understand how parameters and constraints interact to determine the performance of the system(s) we were studying.

7. My knowledge of how to use the computer was adequate to perform the computer operations required in the course.

8. Computer-based instruction makes learning tedious and boring.

9. I felt frustrated by the computer-based instruction situation.

10. I was concerned that I might not understand the material.

11. While I was involved in computer-based instruction I felt as if a person were actually engaged in a conversation with me.

12. The subject matter of the course was tedious and boring.

- - - - - - - - - -

13. In this course the computer-based learning experience:

    A. was a valuable tool which aided me in grasping the course material more readily than would have been possible with traditional instruction alone.

    B. was of some aid to me in understanding course material.

    C. made little difference to me in my attempt to master the material.

    D. was a possible source of hindrance to my mastery of the material.

    E. definitely made it harder for me to master the concepts presented in the course.

Items 14 to 19 list possible sources of difficulty which you may have encountered while using computer-based instruction materials. Please rate these sources of difficulty according to the following code:

    A This was never a problem.

    B. This was seldom a problem.

    C. This problem caused me some difficulty but did not seriously impede my use of the computer materials.

    D. This problem occurred often enough to seriously impede my use of the computer.

    E. This problem occurred so frequently as to discourage me from further use of the computer materials.

- - - - - - - - - - -

14. Logging in.

15. Computer not available.

16. Terminal not available.

17. Long delays in response from computer during modules.

18. Error in program.

19. Equipment malfunction.

On items 20 through 31, please indicate how you felt about the course subject matter and the computer on the various dimensions marked by the pairs of adjectives or phrases below. If, for example, in Item 20, you felt that the course material was very "useless," mark the "E" response. If you considered the course to be slightly "useful," mark the "B" response. Please mark all items.

I felt that the Course Subject Matter was:

20.	useful	A	B	C	D	E	useless
21.	interesting	A	B	C	D	E	uninteresting
22.	important	A	B	C	D	E	unimportant
23.	helpful to me	A	B	C	D	E	hindering to me

I felt that in general, the Computer as an Aid to Mastering Subject Matter was:

24.	useful	A	B	C	D	E	useless
25.	speeded learning	A	B	C	D	E	slowed learning
26.	pleasurable to use	A	B	C	D	E	painful to use
27.	helpful to me	A	B	C	D	E	hindering to me
28.	skillful	A	B	C	D	E	bungling
29.	successful	A	B	C	D	E	unsuccessful

30. I felt that the Computer, as a Tool for Individual Study, was:

useful	A	B	C	D	E	useless

31. I felt that the Computer, as an Aid to Me in Mastering my Major Field, was:

useful	A	B	C	D	E	useless

Factor Analyses of Scores on Attitude toward Computer-Based Instruction Pretest and Posttest Questionnaires, Fall 1973

Varimax rotation factor analyses were performed on attitudinal data gathered for PROJECT C-BE in the fall of 1973. The pretest was given to 863 students, and the posttest to 475 students. From the 34 items on the pretest, 9 roots, accounting for 56.05% of the trace (=39), were extracted by principal components analysis. The first root had 22.02% of the trace, and the second root, 8.43%. After varimax rotation, the first factor contained 16 items, and the second, 5 items.

The posttest had 45 items which resulted in 11 roots having 65.71% of the trace (=45). The first root accounted for 30.39% of the trace, and the second root, 6.39%. The first factor consisted of 22 items, and the second, 6 items. Tables of factors, items, and factor loadings for both tests follow this report.

Of the items belonging to the first two factors for both the pretest and posttest analyses, those which appeared in both tests were chosen to compose two attitude scales: Attitude toward Using the Computer (based on the first factor) and Attitude toward the Course (based on the second factor). The item numbers for each factor and each test are listed following this report. These items were used in subsequent analyses involving attitude toward the course and toward using the computer, and they formed the bases for the revised attitude questionnaires used in the fall of 1974.

Factors and Factor Loadings for the Attitude toward Computer-Based Instruction Questionnaire-- Pretest, 1973-74

Part II Attitude toward Computer-Based Instruction

Items 7 - 45

Directions

The following 35 items are intended to obtain information about the attitudes that you bring to your experience with computer-based instruction. Please be frank. Your answers will remain confidential. Factual information, negative and positive, is sought in the interest of improving instruction.

For items 7 through 18, please indicate whether you agree or disagree with the sentiment expressed. Use the following code.

A. Agree Strongly

B. Agree Moderately

C. No Opinion

D. Disagree Moderately

E. Disagree Strongly

I	.62	1.	The subject matter of this course is interesting to me.
I	.7	2.	Computer-based instruction makes learning more interesting.
I	-.53	3.	I am not in favor of computer-based instruction because it is another step in the depersonalization of education.
VI	.27	4.	In this course the important thing is to learn the facts and prinicples that are being taught.
I	.56	5.	Computers are fascinating gadgets, and I enjoy using them and learning about them.

VII	-.52	6. I am prepared to spend as much time as is necessary to fully understand the material presented in this course.
I	.71	7. Computer-based instruction makes learning more enjoyable.
VII	.63	8. If computer-based instruction will save me time and effort, it will be worthwhile even if I don't learn the material as well as with conventional instruction.
VI	.64	9. When I take a course it is important to me to know how I am doing relative to other students in the course.
VI	.71	10. Interacting with other students and teachers is the most enjoyable aspect of education.
VII	-.66	11. If computer-based instruction will help me to gain a better grasp of the course material, it will be worthwhile even if I have to spend more time on the course than I would in a conventional course.
IX	-.73	12. It is extremely important for me to make a good grade in this course.

Please rank items 19 to 23 in the order of their relative importance to you in the way you usually study for a course of this type.

Use the following code:

A Most Important
B Second Most Important
C Third Most Important
D Fourth Most Important
E Least Important

IV	.63	13. Lectures
V	.49	14. Textbook
IV	-.82	15. Applied experience without computer assistance (working problems, lab exercises, etc.)
V	-.72	16. Discussions with instructor or teaching assistants
I	.40	17. Computer usage

V .44 18. I am taking this course as:

A. A major requirement
B. A minor requirement
C. An elective which I feel is important for my career preparation.
D. An elective, because I expect to enjoy it.
E. An elective, because I need one and this is as good as any.

I .67 19. In this course I feel that the computer will:

A. Be a valuable tool which will aid me to grasp the course material more readily than would be possible with traditional instruction alone.
B. Be of some aid to me in understanding course material.
C. Make little difference to me in my efforts to learn.
D. Be a possible source of hindrance to my mastery of the material.
E. Definitely make it harder for me to master the concepts presented in the course.

On Items 26 through 45, please indicate how you feel about the course subject matter and the computer on the various dimensions marked by the pairs of adjectives or phrases below. If, for example, in Item 26, you feel that the course material is very "obscure," mark the "E" response. If you consider the course to be slightly "clear," mark the "B" response. Please mark all items.

I feel that the Course Subject Matter is:

VIII	.62	20.	clear	A	B	C	D	E	obscure
II	.81	21.	useful	A	B	C	D	E	useless
II	.72	22.	interesting	A	B	C	D	E	uninteresting
II	.79	23.	important	A	B	C	D	E	unimportant
II	.80	24.	helpful to me	A	B	C	D	E	hindering to me

I feel that, in general, the Computer as an Aid to Mastering Subject Matter is:

I	.75	25.	useful	A	B	C	D	E	useless
I	.76	26.	speeds learning	A	B	C	D	E	slows learning
I	.74	27.	pleasurable to use	A	B	C	D	E	painful to use
I	.61	28.	congenial	A	B	C	D	E	quarrelsome
I	.81	29.	helpful to me	A	B	C	D	E	hindering to me
I	.67	30.	skillful	A	B	C	D	E	bungling
I	.74	31.	successful	A	B	C	D	E	unsuccessful
III	.64	32.	I feel that the Computer, as a Research Tool, is:						
			useful	A	B	C	D	E	useless
I	.57	33.	I feel that the Computer, as a Tool for Individual Study, is:						
			useful	A	B	C	D	E	useless
I	.64	34.	I feel that the Computer, as a Tool for Classroom Learning, is:						
			useful	A	B	C	D	E	useless
III	.69	35.	I feel that the Computer, as a Problem Solving Tool, is:						
			useful	A	B	C	D	E	useless
III	.73	36.	I feel that the Computer, as a Computational Tool, is:						
			useful	A	B	C	D	E	useless
III	.55	37.	I feel that the Computer, as an Information Gathering Tool, is:						
			useful	A	B	C	D	E	useless
III	.50	38.	I feel that the Computer, as a Process Simulation Tool, is:						
			useful	A	B	C	D	E	useless
I	.66	39.	I feel that the Computer, as an Aid to Me in Mastering My Major Field, is:						
			useful	A	B	C	D	E	useless

Factors and Factor Loadings for the Attitude toward Computer-Based Instruction Questionnaire--Posttest, 1973-74

II	.70	1.	The subject matter of this course is interesting to me.
I	.79	2.	Computer-based instruction makes learning more interesting.
I	-.61	3.	I am not in favor of computer-based instruction because it is another step in the depersonalization of education.
I	.75	4.	Computer-based instruction makes learning more enjoyable.
I	.75	5.	Considering the effort I applied to this course, the computer provided me with valuable learning assistance.
I	.46	6.	The part of the course in which computer-based instruction was used was well integrated with the conventional segments of the course.
I	.59	7.	The use of the computer in the course stimulated me to seek more information about the subject matter.
I	-.73	8.	If I had it to do over again I would prefer to take this course in a conventional section (without computer-based instruction) rather than a computer-based section.
I	.76	9.	Considering its value in aiding me to master the course material, the time I spent using the computer during this course was definitely worthwhile.
X	.79	10.	Working with other students in study sessions or bull sessions was an important aspect of my learning experience in this course.

Answer Subset A (Items 11-14) only if you have been instructed to do so. Otherwise go on to Item 15.

III	.70	11.	The computer did so much of the work in the lessons that I didn't learn as much as if I had done all of the computations myself.
I	.55	12.	The use of the computer made it possible for me to concentrate most of my attention on the concepts involved in the lessons without getting bogged down in details.
I	.53	13.	The use of the computer allowed me to understand how parameters and constraints interact to determine the performance of the system(s) we were studying.
III	-.69	14.	My knowledge of how to use the computer was adequate to perform the computer operations required in the course.

Answer Subset B (Items 15-17) only if you have been instructed to do so. Otherwise go on to Item 18.

I -.52 15. I felt frustrated by the computer-based instruction situation.

I -.76 16. I was concerned that I might not understand the material.

17. While I was involved in computer-based instruction I felt as if a person were actually engaged in a conversation with me.

Please rank items 18-22 in the order of their relative importance to you in mastering the material presented in this course.

Use the following code:

A Most Important
B Second Most Important
C Third Most Important
D Fourth Most Important
E Least Important

IX -.59 18. Lectures

VIII .82 19. Textbook

IX .85 20. Applied experience without computer assistance (working problems, lab exercises, etc.)

VI -.79 21. Discussions with instructor or teaching assistants.

I .61 22. Computer usage.

I .72 23. In this course the computer-based learning experience:

A. was a valuable tool which aided me in grasping the course material more readily than would have been possible with traditional instruction alone.

B. was of some aid to me in understanding course material.

C. made little difference to me in my attempt to master the material.

D. was a possible source of hindrance to my mastery of the material.

E. definitely made it harder for me to master the concepts presented in the course.

VI .59 24. Which of the following statements do you consider to be most accurate in regard to the time requirements imposed by this course as compared to similar courses without computers?

A. The computer greatly increased the time that I had to devote to this course.

B. The computer slightly increased the time I had to spend on this course.

C. The computer made no difference in the time I had to spend on the course.

D. The computer slightly decreased the amount of time I spent on the course.

E. The computer greatly decreased the amount of time that I was obliged to devote to this course.

VII .76 25. Which of the following possible sources of difficulty caused you the most trouble during the computer-based segment of the course?

A. Logging in.

B. Computer not available.

C. Terminal not available.

D. Error in Program.

E. Equipment malfunction.

On Items 26 through 45, please indicate how you felt about the course subject matter and the computer on the various dimensions marked by the pairs of adjectives or phrases below. If, for example, in Item 26, you felt that the course material was very "obscure," mark the "E" response. If you considered the course to be slightly "clear," mark the "B" response. Please mark all items.

I felt that the Course Subject Matter was:

II	.53	26. clear	A	B	C	D	E	obscure
II.	.80	27. useful	A	B	C	D	E	useless
II	-.61	28. uninteresting	A	B	C	D	E	interesting
II	.77	29. important	A	B	C	D	E	unimportant
		30. helpful to me	A	B	C	D	E	hindering to me

I felt that, in general, the Computer as an Aid to Mastering Subject Matter was:

I	.80	31. useful	A	B	C	D	E	useless
I	.72	32. speeded learning	A	B	C	D	E	slowed learning
I	.59	33. pleasurable to use	A	B	C	D	E	painful to use
I	.59	34. quarrelsome	A	B	C	D	E	congenial
I	.78	35. helpful to me	A	B	C	D	E	hindering to me
I	-.47	36. bungling	A	B	C	D	E	skillful
I	.73	37. successful	A	B	C	D	E	unsuccessful

V .63 38. I felt that the Computer, as a Research Tool, was:

useful A B C D E useless

I .64 39. I felt that the Computer, as a Tool for Individual Study, was:

useful A B C D E useless

I .65 40. I felt that the Computer, as a Tool for Classroom Learning, was:

useful A B C D E useless

V .75 41. I felt that the Computer, as a Problem Solving Tool, was

useful A B C D E useless

V .73 42. I felt that the Computer, as a Computational Tool, was:

useful A B C D E useless

V .64 43. I felt that the Computer, as an Information Gathering Tool, was:

useful A B C D E useless

V. .52 44. I felt that the Computer, as a Process Simulation Tool, was:

useful A B C D E useless

I .69 45. I felt that the Computer, as an Aid to Me in Mastering my Major Field, was:

useful A B C D E useless

Table 1

Results of Principal Components Analyses

on Attitude Questionnaire Data

Pretest

34 variables, NS = 863

9 Roots extracted 56.05% trace (=39).

R_1 had 22.02% trace.

R_2 had 8.43% trace.

Posttest

45 variables, NS = 475

11 Roots, 65.71% trace (=45).

R_1 had 30.39% trace.

R_2 had 6.39% trace.

Table 2

Loadings on Items on Factors I and II
for Pretest and Posttest Attitude Questionnaire Data

Pretest (N=863) 24 items				Posttest (N=475) 45 items			
Factor I		Factor II		Factor I		Factor II	
Item Number	Factor Loading	Item Number	Factor Loading	Item Number	Factor Loading	Item Number	Factor Loading
29	.81	21	.81	31	.80	30	.81
26	.77	24	.80	2	.80	27	.80
25	.75	23	.79	35	.78	29	.77
31	.74	22	.72	9	.76	1	.71
27	.74	1	.62	5	.75	28	-.61
2	.73			4	.75	26	.53
7	.71			37	.73		
19	.67			8	-.73		
30	.67			23	.72		
39	.66			32	.72		
34	.64			45	.69		
28	.61			40	.65		
33	.57			39	.64		
5	.57			22	.61		
3	-.53			3	-.61		
17	.40			7	.59		
				33	.59		
				12	.56		
				13	.54		
				15	-.52		
				36	-.47		
				6	.46		

Table 3

Corresponding Pre-Post Items for Factors I and II:

Item Numbers and Factor Loadings*

Factor I

Pretest		Posttest	
Item Number	Factor Loading	Item Number	Factor Loading
2	.73	2	.80
3	-.53	3	-.61
7	.71	4	.75
17	.40	22	.61
19	.67	23	.72
25	.75	31	.80
26	.77	32	.72
27	.74	33	.59
29	.81	35	.78
30	.67	36	-.47
31	.74	37	.73
33	.57	39	.64
39	.66	45	.69

Factor II

Pretest		Posttest	
Item Number	Factor Loading	Item Number	Factor Loading
1	.62	1	.71
21	.81	27	.80
22	.72	28	-.61
23	.79	29	.77
24	.80	30	.81

*Pretest items were matched with posttest items from left to right.

COMPUTER-BASED EDUCATION COURSES

AEROSPACE ENGINEERING

Aircraft Design—Drs. W. T. Fowler and D. G. Hull
Structural Analysis—Dr. Eric Becker

ARCHITECTURE

Survey of Environmental Control Systems—Dr. F. N. Arumi

CHEMICAL ENGINEERING

Process Analysis and Simulation—Dr. D. M. Himmelblau
Optimal Control—Drs. T. F. Edgar, E. H. Wissler and J. O. Hougen

CHEMISTRY

Vector Space Theory of Matter—Dr. F. A. Matsen
Physical Chemistry Laboratory—Dr. John M. White
Organic Chemistry—Drs. J. C. Gilbert and G. H. Culp
Introductory Chemistry—Dr. J. J. Lagowski
Principles of Chemistry—Dr. J. J. Lagowski
Introduction to Chemical Practice—Dr. J. J. Lagowski

CIVIL ENGINEERING

Computer Methods for Civil Engineering Laboratory—Dr. C. Philip Johnson et. al.

ECONOMICS

Theory of Income and Employment—Dr. James L. Weatherby

ENGLISH

English Composition—Dr. Susan Wittig

HOME ECONOMICS

Child Development—Dr. Mary Ellen Durrett

LINGUISTICS

Language and Society—Dr. W. P. Lehmann

MATHEMATICS

Calculus I, II—Dr. John P. Alexander

MECHANICAL ENGINEERING

Dynamic Systems-Synthesis—Dr. L. L. Hoberock
Probability and Statistics for Engineers—Dr. G. R. Wagner
Energy Systems Laboratory—Dr. G. C. Vliet
Element Design—Dr. John J. Allan III
Nuclear Reactor Engineering—Dr. B. V. Koen
Kinematics and Dynamic Mechanical Systems—Dr. W. S. Reed

PSYCHOLOGY

Introduction to Psychology—Self Paced—Dr. Jan H. Bruell
Statistical Methods in Psychology—Dr. James M. Swanson

PHYSICS

Computer Introduction to Physics—Dr. J. D. Gavenda

ZOOLOGY

Genetics—Dr. Richard Richardson
Experimental Genetics—Dr. Richard Richardson
Biophysical Analysis—Dr. J. L. Fox