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ABSTRACT

The relationship between students' evaluations and both cognitive and affective consequences of instruction was investigated. A total of 924 undergraduate students of the University of California at Los Angeles who had completed an introductory computer programming class were subjects. Responses to a 38-item evaluation questionnaire provided students' perceptions of instructional effectiveness at the end of each quarter. A correlation matrix was computed for the items based on individual student responses. Factor analysis, a principal components solution followed by a varimax rotation, of the correlation matrix, which yielded an orthogonal solution, was carried out. The evaluation instrument also included five items designed to provide information about a student's perception of his or her affective growth. Results confirmed that by the end of the quarter, students' evaluations of instructional effectiveness were positively related to their achievement in the course. Ratings on the evaluation dimensions "concern" and "examinations," as well as on the overall instructor rating item, bore the strongest relationships with students' positive cognitive outcomes. Definite, statistically significant relationships with affective outcomes were found both for the overall course summary item, and for the rating components of "concern," "examinations," "interaction," and "learning." The questionnaire items are appended. (SW)

COGNITIVE AND AFFECTIVE OUTCOMES: THEIR RELATIONSHIP TO EFFECTIVE TEACHING AND STUDENTS' EVALUATIONS OF INSTRUCTION

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ABSTRACT

Cognitive and Affective Outcomes: Their Relationship to Effective Teaching and Students' Evaluations of Instruction

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An investigation into the relationship between students' evaluations and both cognitive and affective consequences of instruction showed positive, statistically significant validity coefficients. Cognitive outcomes (students' achievement on an end-of-course examination) showed the strongest relationships with the CONCERN and EXAMINATIONS rating factors. Affective outcomes (students' feelings of course mastery and disposition to pursue the subject further) showed the strongest relationships with the CONCERN, EXAMINATIONS, INTERACTION, and LEARNING rating factors. In terms of the summary rating items: 1) students' achievement correlated .41 ($p<.05$) with the Overall Instructor item, but .19 (n.s.) with the Overall Course item; and, 2) the affective outcomes correlated between .52 and .63 ($p<.01$) with the Overall Course item, but between .22 and .31 (n.s.) with the Overall Instructor item. These findings provide further support for the validity of students' evaluations, and suggest that by using criteria related to both cognitive and affective outcomes, it is possible to obtain a much broader insight into teaching effectiveness.

COGNITIVE AND AFFECTIVE OUTCOMES: THEIR RELATIONSHIP TO EFFECTIVE TEACHING AND STUDENTS' EVALUATIONS

The use of students' evaluations of instruction as an index of effective teaching is still one of the most controversial issues facing the academic community today. A significant aspect of this controversy is the insistance by critics that positive relationships be shown between such evaluations and generally acceptable validity criteria.

In the past few years, the most widely emphasized and accepted index of validity has been that of students' achievement. If instructors do not receive the highest ratings from those students who learn the most, the use of such ratings as an indication of effective teaching is suspect.

Recently, the importance of affective outcomes and their relationship to effective teaching has also generated a great deal of interest. Two primary objectives of any curriculum are the provision of opportunities to develop 1) knowledge that will provide a basis for confidence in subject matter mastery, and 2) interest in pursuing the subject further independently. Finding positive relationships between such outcomes and students' evaluations of instructors would provide additional support for the validity of students' evaluations.

In light of the apparent importance that cognitive and affective consequences have for students in the instructional setting, and because of the absence of validity research, particularly with respect to affective outcomes, the present study was conducted. The purpose of this research then, was to investigate--at the college and university level--the relationship between students' evaluations of instructional effectiveness and both cognitive and affective outcomes of instruction.

LITERATURE REVIEW

Cognitive Outcomes

The most commonly accepted validity index for students' evaluations has been students' achievement. Some researchers have focused on the use of actual or expected grades to indicate such achievement. Results of these studies have been comprehensively reviewed elsewhere (Costin, Greenough and Menges, 1971; Trent and Cohen, 1973). However, because grades may be biased by subjective factors such as personality or forced grade distributions, and because there is some evidence that students may award higher ratings if their grading expectations are met or exceeded (Marsh, Overall and Thomas, 1976), some measure of a student's actual gain in knowledge or understanding is probably a more preferable criteria.

More recent research has utilized students' performance on a common examination as its criteria for validity. If students' evaluations of instruction are shown to be positively related to students' performance or achievement, then one may reasonably

conclude that these evaluations are valid indicators of instructional effectiveness. College and university level studies of this relationship have been conducted by Bendig (1953); Centra (1977); Cohen and Berger (1970); Frey (1973); Gessner (1973); Marsh, Fleiner and Thomas (1975); McKeachie, Lin and Mann (1971); Morsh, Burgess and Smith (1956); Overall (1977); and, Rodin and Rodin (1972). All studies used a multi-sectioned approach, and an emphasis on common content or course examinations was apparent in all but the McKeachie study. Although the Rodin and Rodin research was the only one to report negative results, the limitations peculiar to that study have been thoroughly discussed by Frey and Gessner in subsequent articles.

Affective Outcomes

The development of positive attitudes toward course experiences and subject matter by students has received a great deal of attention from educational practitioners in recent years. This has resulted in instructor concerns that students feel confident about and disposed toward using what they have learned in a course after its completion. It is expected that the development of positive attitudes toward a subject will not only assist the student in mastering the cognitive aspects of the particular subject, but will also reinforce these positive attitudes in the student after a particular course has ended (Krathwohl, Bloom and Masia, 1964; Popham and Baker, 1970).

Fletcher (1959) underscored the importance of affective development when he summarized the significant role reinforcement

plays in improving a skill or increasing knowledge. He observed that students who developed positive attitudes toward the subject matter in a course would voluntarily seek out situations to apply the cognitive knowledge they had gained after the course was over, thus reinforcing any learning that had previously taken place. Weinstein and Fantini (1970) also have pointed out the relationship between cognitive and affective development. To them, there is little chance that subject matter mastery will influence behavior unless it is somehow related to an affective state in the learner.

Pohlmann (1975) sought to determine the relationship between specific predictor items and an overall summary item ("in general, taught the class effectively") used in his Instructional Improvement Questionnaire at Southern Illinois University. Using partial correlation to statistically remove effects from the other rating items, he found that of the 29 predictor items, 11 had partial correlations of .10 or higher with the criterion; however, only three items correlated .21 higher, and one of these was the affective item "increased your appreciation of the subject."

Overall and Marsh (1977) provided summaries of mid-quarter (MQ) evaluations by students to a random half of the instructors teaching an introductory course in computer programming. The 993 University of California undergraduates involved were typically social science majors who took the course during one of the three quarters to fill departmental requirements. The

impact of feedback from the students' evaluations was assessed by comparing responses of students whose instructors either did or did not receive such feedback. Based on end-of-quarter evaluations, students of instructors who received MQ feedback gave more favorable responses to each of five affective consequence items (identical to those used in this study) than did students whose instructors did not receive feedback. On three of the five items, the differences were statistically significant. MQ feedback was thus found to be positively related to differences in students' affective outcomes.

METHODOLOGY

Subjects for the study were 30 sections (924 students) of University of California, Los Angeles, undergraduates who completed Engineering 10 (E 10), an introductory computer programming class, during one of the three quarters in a recent academic year. The course was taught by graduate teaching assistants (TAs); the syllabus, text and final examination were standardized under supervision of the course director. Participating students were all non-science majors; a majority came from the social sciences. The section was chosen as the unit of analysis.

At the start of each quarter, students voluntarily selected themselves into one of the available sections of E 10, solely on the basis of the time a particular section was offered. This voluntary selection procedure was crucial in creating a sample

that approximated a truly random one. A previously validated pretest was administered to determine if sections differed to any statistically significant extent with respect to ability. No such differences were found. Responses to a 38-item evaluation questionnaire provide students' perceptions of instructional effectiveness at the end of each quarter.

The evaluation instrument was a variant of the standard form developed by the UCLA Evaluation of Instruction Program. A correlation matrix was computed for the items based on individual student responses. Factor analysis--a principal components solution followed by a varimax rotation--of the correlation matrix yielded the orthogonal solution shown in Appendix 1. The factors and sample items were as follows: a) Instructor CONCERN--presentations made subject more understandable; implications, applications and concern that students learn and understand subject matter were shown. b) BREADTH--various points of view were discussed; implications of various theories were contrasted. c) ORGANIZATION--course materials and objectives were clearly outlined; class presentations were well prepared. d) INTERACTION--students were encouraged to ask meaningful questions and were free to disagree with the instructor. e) LEARNING--students learned something of value and developed an understanding of the implications of the course material; intellectual curiosity was stimulated. f) EXAMINATIONS--grading was fair and objective; graded materials fairly measured knowledge of course as emphasized by the instructor.

g) DIFFICULTY--magnitude of course workload; difficulty of the course compared to other courses; amount of time spent on course outside of class. Overall instructor and course rating items were also included. Factor scores were generated for each individual factor (evaluation dimension). These scores were computed by taking an unweighted average of the standardized mean of individual responses to the rating items loading highest on each factor. These factor scores were then standardized to have a mean of 100 and a standard deviation of 10.

The evaluation instrument also included five items designed to provide information about a student's perception of his or her affective growth.

1. Extent...you feel capable of writing and running a computer program to solve some problem which you may run into in the future.
2. Extent...you have gained enough understanding of what a computer is capable of to be useful to you in the future.
3. Extent...you plan to become (or remain) a member of the UCLA Computer Club or find some other source which will provide computer time in the future.
4. Extent...you plan to make practical application of the computer in the future.
5. Extent...you plan to take more computer courses (for credit or through the Computer Club) in the near future.

RESULTS

The CONCERN and the EXAMINATIONS dimensions had statistically significant relationships with cognitive and affective outcomes. However, while the correlation between the CONCERN factor and achievement was significant, the correlations between CONCERN and the five affective variables reached significance on only two items. The magnitude of the correlations between the EXAMINATIONS factor, and both students' cognitive and affective development was substantial.

Two evaluation dimensions had statistically significant correlations with the affective outcomes, but not with the cognitive outcomes. One of these dimensions, LEARNING, had a small positive relationship with students' performance on the common final examination, but was clearly much more related to students' feelings of course mastery and disposition to pursue the subject further. The other dimension, INTERACTION, had significant correlations with two of the affective development items, and a positive but small relationship with achievement.

Perhaps the most interesting finding was that the Overall Instructor rating item had a statistically significant relationship with students' achievement, but not with students' affective development. On the other hand, the Overall Course rating item had a statistically significant relationship with the affective outcome variables, but not with students' achievement.

A summary of these results is presented in Table One.

-----Insert Table One About Here-----

DISCUSSION

Cognitive Outcomes

The results obtained in this study confirmed that by the end of the quarter, students' evaluations of instructional effectiveness were positively related to their achievement in the course. Ratings on the evaluation dimensions CONCERN and EXAMINATIONS, as well as on the overall instructor rating item, bore the strongest relationships with students' positive cognitive outcomes.

Cognitive development was very definitely related to the CONCERN dimension, which includea items reflecting students' perceptions of instructors' concern, enthusiasm, and attempts to make the course relevant and understandable. Certainly, one way to communicate an interest in something is to be enthusiastic about it. Furthermore, if one wants individuals to learn something, one can provide positive reinforcement to them by showing that their learning is relevant and important--both to them and to others.

The EXAMINATIONS dimension also showed a strong and statistically significant correlation with students' cognitive development. Those students who perceived a sense of fairness and objectivity in the grading and testing processes also achieved higher scores on the common final examination. The specification of what the student is expected to learn, and the evaluation of the student with respect to the material specified, is very important to the creation of an effective learning environment.

In this study, the extent to which students perceived they were being evaluated on what they were asked to learn was very clearly related to their achievement.

Finally, the Overall Instructor rating showed a strong and statistically significant correlation with students' achievement. The magnitude of this finding was, of course, quite relevant to the question of validity. If students' summary evaluations of instruction showed little relationship to cognitive development, then the validity of such evaluations would be suspect. However, such was not the case, and the two variables--Overall Instructor rating and cognitive development--were clearly related.

Affective Outcomes

Definite, statistically significant relationships with affective outcomes were found both for the Overall Course summary item, and for the rating components of CONCERN, EXAMINATIONS, INTERACTION, and LEARNING. There was a positive but weak relationship between the Overall Instructor rating and affective development.

Two of five affective outcomes had significant relationships with the CONCERN and INTERACTION dimensions. Although not as high as the correlations with achievement, the correlations with these factors nevertheless indicated a consistent positive relationship. Thus, an instructor's enthusiasm, attempts to show implications and applications of the material, projection of concern that students learned and understood the subject, and efforts to foster instructor-student interaction were clearly associated with students' feelings of course mastery and future plans for pursuing the subject.

Affective development was also associated with the EXAMINATIONS factor. Students' perceptions of a sense of objectivity and fairness in their instructor's grading and examination practices correlated strongly with feelings of subject matter mastery and expectations of pursuing the subject after the end of the course. Apparently, students of instructors who both let them know what was expected and subsequently evaluated them on the basis of this expectation, developed very positive affective relationships to the subject matter. The instructor's evaluation procedures were thus a positive influence on students' affective development.

One explanation for this relationship could be that if there was effective communication between student and instructor concerning what was to be learned from the course, and if examinations reflected the material emphasized, then students' expectations of content mastery were in harmony with actual results. This harmony created a reinforcing effect on the students with respect to their confidence both in immediate mastery and in future probability of success in pursuing the subject independently. It is natural for one to pursue a subject for which he or she appears to have an affinity, and the students in this study were apparently no exception. In addition, given that the EXAMINATIONS dimension was also correlated with achievement to a statistically significant extent, this explanation is quite plausible.

Affective development showed the highest correlations with the LEARNING factor. Students' sense of course mastery and interest in pursuing the subject matter further after the course had ended correlated to a statistically significant extent with students' feelings that they had learned something of value, that they understood the implications of the material, and that their intellectual curiosity had been stimulated. These findings were anticipated because individuals are more likely to pursue subjects that they understand, and that appear interesting and of value to them.

Finally, positive affective outcomes had a significant relationshp with the Overall Course--but not the Overall Instructor--rating. Those students who, by the end of the quarter, felt both a greater sense of course mastery, and a greater interest in studying the subject matter further after the end of the course, rated it higher than those who did not. This result is intriguing because in a previous study using a similar research setting, Marsh, Fleiner and Thomas (1975) reported finding a correlation of .42 ($p<.05$) between students' achievement and Overall Instructor rating. However, they also found a positive but statistically insignificant correlation of .30 between achievement and Overall Course rating. With the addition of affective outcome measures in the present study, a possible explanation for such findings can be proposed. Apparently, Overall Instructor ratings, while positively related to both cognitive and affective outcomes, have a much greater association with students' perceptions of behaviors and actions over which the instructor has direct control. Some

examples are instructors' presentations that are enthusiastic and understandable, and grading that was fair and objective. The Overall Course rating--while positively related to both cognitive and affective outcomes--had a much greater association with students' feelings of course mastery and interest in studying the subject after the end of the course. Thus, while students' assesments of their instructors reflected their level of cognitive development as a result of the course, students' assessments of their course reflected their level of affective development. Because instructors seek to insure that their students attain both cognitive and affective outcomes in most teaching situations, then the extent to which these outcomes have been attained can be determined from students' evaluations.

In conclusion, it should be noted that not all evaluation factors or items reflected both cognitive and affective outcomes. Previous research has identified those factors and items most related to cognitive development, and the present study has confirmed those findings. In addition, this study has suggested that other factors or items which are much less strongly related to cognitive development may instead reflect environments conducive to the attainment of affective outcomes. These items provide further support for the validity of students' evaluations, and should, of necessity be included in evaluation questionnaires if coverage of both cognitive and affective development is desired. Certainly, using criteria related to both cognitive and affective outcomes, it is possible to obtain a much broader insight into teaching effectiveness.

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TABLE ONE

CORRELATIONS OF STUDENT COGNITIVE AND AFFECTIVE DEVELOPMENT WITH EOQ STUDENT RATINGS ON THE SEVEN EVALUATION FACTORS AND TWO SUMMARY RATING ITEMS

Evaluation Factor/Item	Correlation of EOQ Evaluations With--					
	Cognitive Development	Affective Development Item				
		32	33	34	35	36
CONCERN	.43*	.31	.36*	.37*	.26	.32
ORGANIZATION	.20	.34	.39*	.18	.12	.15
LEARNING	.28	.78**	.70**	.70**	.79**	.62**
INTERACTION	.28	.21	.28	.36*	.26	.36*
BREADTH	.24	.28	.07	.19	.00	.20
DIFFICULTY	.21	.28	.05	.27	.15	.24
EXAMINATIONS	.44*	.42*	.57**	.38*	.32	.38*
OVERALL RATING OF INSTRUCTOR	.41*	.26	.30	.31	.22	.29
OVERALL RATING OF COURSE	.19	.63**	.63**	.59**	.68**	.52**

*P < .05, two-tailed.
**P < .01, two-tailed.

APPENDIX I

Factor Analysis of the Evaluation Items

A factor analysis (principal components solution followed by a varimax rotation) of the correlation matrix based on end-of-quarter evaluations produced the results shown below. The loading of each item on the factor it was designed to measure appears in a bold box; loadings of less than .20 are indicated with dashes. Every item loads higher on its own factor than on any other. The factors are moderately intercorrelated, with correlations ranging from .03 to .50 (median .25). The factors are generally positively related to each other, with the exception of the DIFFICULTY factor; it has low negative to zero correlations with the other factors.

Evaluation Items	I	II	III	IV	V	VI	VII
I LEARNING							
Intellectual curiosity in subject stimulated	**.74**	-	-	-	-	-	-
Learned something valuable	**.72**	-	-	-	-	-	-
Present interest in course subject	**.69**	-	-	-	-	-	-
Developed understanding of practical implications	**.48**	-	-	-	-	-	-
Degree of course mastery	**.43**	-	-	-	-	-	.32
II CONCERN							
Instructors presentations made subject understandable	-	**.75**	-	-	-	-	-
Instructor concerned with student learning/understanding	-	**.55**	-	.30	-	-	-
Instructor enthusiastic about teaching	-	**.47**	-	.34	-	-	-
Instructor made course relevant	-	**.43**	-	-	.40	-	-
III ORGANIZATION							
Course material outlined and carefully explained	-	.20	**.67**	.25	-	-	-
Course objectives stated and agreed with those actually pursued	-	-	**.63**	.24	-	-	-
Nature/purpose of assignments clear	-	-	**.53**	.26	-	-	-
Presentation well prepared and integrated	-	.40	**.44**	-	-	-	-
Workload evenly spread over term	-	-	**.34**	-	-	-	-
IV STUDENT-TEACHING INTERACTION							
Students welcomed to seek help/advice	-	-	-	**.63**	-	-	-
Students encouraged to ask questions and were given answers	-	.32	-	**.59**	-	-	-
Students free to disagree and/or express own ideas	-	-	-	**.59**	-	-	-
V BREADTH OF COVERAGE							
Instructor contrasted implications of theories	-	-	-	-	**.79**	-	-
Instructor presented background/origin of ideas/concepts	-	-	-	-	**.65**	-	-
Instructor discussed different points of view	-	-	-	-	**.63**	-	-
VI EXAMINATIONS/GRADING							
Graded materials adequately measured your knowledge	-	-	-	-	-	**.81**	-
Graded materials measured content as emphasized in course	-	-	-	-	-	**.74**	-
Grading was fair and objective	-	-	-	-	-	**.56**	-
VII WORKLOAD/DIFFICULTY							
Workload/pace was difficult	-	-	-	-	-	-	**.65**
Course difficulty	-	-	-	-	-	-	**.63**
Hours/week outside of class	-	-	-	-	-	-	**.43**
OVERALL INSTRUCTOR RATING	-	.52	-	.26	-	-	-
OVERALL COURSE RATING	.51	-	.20	-	-	-	-