Kay, R. H. (1990a). Predicting student teacher commitment to the use of computers. *Journal of Educational Computing Research, 6*(3), 299-309.

Predicting Student Teacher Commitment to the Use of Computers

Robin H. Kay
University of Toronto

Running Head: PREDICTING STUDENT

ABSTRACT

This study explored the effectiveness of computer attitudes, computer literacy, computer locus of control, and gender in predicting commitment to the use of computers.

Three hundred and eighty-three education students, completed a survey about commitment to the use of computers (actual use, interest, and promotion), computer attitudes (affective and cognitive), computer literacy (experience, basic skills, application software, awareness, programming), and locus of control (specific to the use of computers). The results suggest that cognitive attitude, awareness, and application software ability were the best predictors of commitment to the use of computers. Less effective, but significant predictors, included affective attitude, locus of control and gender.

Predicting Student Teacher Commitment to the Use of Computers

The introduction of the microcomputer in education has proven to be a double-edged sword: a tremendous educational opportunity on the one hand; a source of anxiety and threat on the other hand. Many teachers recognize the potential benefits of using the microcomputer, but substantial investment in more traditional methods of instruction makes it difficult to readily accept this `wonder machine' [1], especially considering the marginal impact of previously heralded `wonder technologies' such as educational radio, films, and television [2]. Nonetheless, society expects the educational system to assume the responsibility of imparting computer skills on today's youth.

In response to the public cry for increased computer use in education, governments have invested considerable time, money and effort into software, hardware and training. The results have not always been positive. Although many computer enthusiasts have vehemently endorsed this new technological revelation [1, 3-8] the acceptance of computers in schools is far from being a foregone conclusion [9-14].

Unless we are prepared to risk an enormous investment of time and money, we need to look at those factors that influence the indoctrination of computers into schools. One essential factor is educator commitment to the use of computers. Other factors such as the availability of hardware, software and

training courses, as well as time constraints, also influence the use of computers, but it is commitment that lies at the heart of a successful computer-related program. Without educator commitment, it is unlikely that computers will be used effectively, if at all, in the classroom.

Researchers have yet to examine individual commitment to the use of computers. Instead they have focused on relations among a variety of variables, including attitudes, computer literacy, locus of control and gender. While the results of these studies are interesting, they give us little direct insight into predicting the successful use of computers in education. There may be an implicit assumption that these variables predict the successful use of computers, but it has not been tested empirically.

Measures used to assess attitudes toward computers, computer literacy, and locus of control have been loosely structured and to some extent, statistically weak. A number of attitude scales, for example, are composed of an indiscriminate mix of affective, cognitive and behavioral items [15-23]. Even the most sophisticated statistical tests cannot sort out this ideological muddle. With respect to computer literacy, several measures have been found to be statistically sound, but focus almost exclusively on the areas of programming and technology [4, 11, 22, 24-35]. Little in the way of explanation is offered to substantiate these technology focused measures. Finally, statistically reliable instruments based on social-political

issues have been used to assess locus of control with respect to computers [30-33]. The direct relation between the domains of social-politics and computers is never established in these studies. Clearly a more apropos mixture of theoretical sustenance and statistical rigour is required in measurement devices used to assess computer attitudes, literacy and locus of control, so that more forceful conclusions can be drawn.

The present study uses a multicomponent assessment of computer literacy consisting of four subscales, a bidimenisonal measure of computer attitudes (cognitive and affective) and a locus of control measure that focuses exclusively on the use of computers.

The purpose of the current study is to use statistically reliable and tightly structured measures to determine the effectiveness of computer attitudes, literacy, locus of control and gender in predicting student teacher commitment to the use of computers.

Method

Sample

The sample consisted of 383 students (33% male, 67% female), ranging in age from 22 to 51 years (M=27.2 years), enroled in the Faculty of Education at the University of Toronto. Most students had obtained their Bachelor's degree (79%). Twenty percent had acquired their Masters degree and 1% had their Doctoral degree. Of the 383 subjects, 18% (6 males, 64 females)

intended to teach primary/junior pupils (junior kindergarten to grade 6), 21% (17 males, 63 females) intended to teach junior/intermediate pupils (grades 4 to 10) and 61% (104 males, 128 females) intended to teach intermediate/senior pupils (grades 7 to 12). Regarding subject area to be taught, 25% (50 males, 45 females) of students were planning to teach math-science-business oriented courses, 49% (54 males, 133 females) to teach the humanities, and the remaining 26% (23 males, 77 females) to teach a general curriculum.

Description of Instruments Used

The Student Teacher Computer Survey consisted of six sections. The first section gleaned demographic information and computer experience. The next four sections were composed of questions on a 7 point Likert scale. The final section consisted of questions based a 7 point semantic differential scale.

Demographic information and computer experience. Gender, age, teaching level, subject area to be taught, highest level of education attained, and principal subject matter of last degree, made up the demographic questions.

Commitment to computers. Commitment to the use of computers was divided into 3 subscales consisting of computer interest (8 questions), computer promotion (8 questions) and actual computer use (8 questions).

Computer attitudes. The cognitive component of computer attitudes consisted of 14 questions. Odd questions were positive statements about computers; even questions were negative

statements. The affective component of attitudes was assessed using a 7 point semantic differential scale (20 questions). Odd questions had a negative adjective on the left side; even questions had a positive adjective on the left side.

Computer literacy. Computer literacy was measured using 5 subscales: computer experience, basic skills, application software ability, awareness and programming. Computer experience was determined from number of computer-related courses taken, number of years using any kind of computer, and typical weekly use of a computer, determined by the average number of days and hours that a subject used a computer. The remaining literacy subscales consisted of six questions each for a total of 24. Items one to six asked about basic skills, seven to 12 about application software, 13 to 18 about computer awareness and the remaining 6 focused on programming. Note that this was a self-report measure asking the subject about confidence in personal ability to do a particular computer-related task. This wording was used in an attempt to control for extraneous factors such as availability of computers, computer experience and time.

Locus of Control. Computer locus of control consisted of 14 questions. Odd-numbered questions, when answered in the affirmative, indicated an external locus of control. Even-numbered questions when answered in the affirmative, indicated an internal locus of control.

Reliability of Instruments Used

The reliability coefficients of the measures used for the study are presented in Table 1. All internal reliability coefficients were statistically significant ($p<.001$). Overall, the internal reliability coefficients for measures of computer commitment ($r=.96$), attitudes ($r=.94$, literacy ($r=.97$) and locus of control ($r=.86$) were excellent. Individual subscale coefficients for all variables ranged from .86 to .95.

Insert Table 1 about here

Procedure

Professors from the Educational Psychology Department were asked to volunteer 15 minutes of class time to distribute the Student Teacher Computer Survey. Four of seven professors agreed to have their students fill out the survey during class time. A fifth professor agreed to have the survey handed out, but not completed during class. Eighteen classes participated in the survey.

Before the surveys were handed out, it was stressed that participation was completely optional and that students choosing not to do the survey could take a 15 minute coffee break. Students were told that the survey was being used to obtain information about the use of computers in education and that the data would be used for a Master's thesis. The students were also encouraged to pick up a one page "debriefing" summary after they

had filled out the survey.

Of the 387 surveys handed out and completed in the classroom, 372 (96%) were returned. Of the 78 surveys handed out, but not filled in during class, 11 (14%) were returned. Overall 383 of 465 (82%) of the surveys handed out were completed.

Research Design and Method of Analysis

The dependent variable in the study was commitment to the use of computers, which was divided into 3 subscales: interest, promotion and actual use. The independent variables were computer attitudes (cognitive and affective subscales), computer literacy (experience, basic skills, application software, awareness and programming subscales), computer locus of control and gender.

Descriptive statistics were generated for demographic, independent, and dependent variables for the total population. Multiple regression was used to determine the effectiveness of independent variables to predict commitment to computers. The model was assumed to be linear and additive. The first step in the analysis was to enter all independent variables into a regression equation to determine the relative importance of each. The ENTER procedure from the statistical package SPSSX was used. The second step was to determine the most efficient predictor equation employing the ENTER/BACKWARD procedure to eliminate those variables with probability levels less than .10.

Results

Means

The means, standard deviations, and ranges for all dependent and independent variables are presented in Table 1. The means for all three commitment subscales were virtually identical. Regarding computer literacy subscales, the mean scores for basic skills, application software aptitude and awareness were similar, whereas the programming mean was seven to 12 points lower.

Correlations

Correlations among total test scores are presented in Table 2. All correlations were significant (p <.001) except for attitudes and gender. Correlations were low (r <.30) among gender and all other total test scores. The only other correlation under .50 was between attitudes and computer literacy. Besides the correlations among subscales and total test scores for the dependent variable, the only correlation above .70 was locus of control and computer literacy (r=.77).

Insert Table 2 about here

Multiple Regression Analysis

Complete Model Using Subscale Test Scores. The multiple regression equation, employing all subscale score to predict total commitment, is presented in Table 3. Cognitive attitudes appeared to be the best predictor of total commitment. Awareness, locus of control, affective attitudes and gender were also

significant predictor variables. Application software skills had a high B weight, but a similarly high standard error prevented it from being a significant predictor. Multicollinearity may have been a problem due to the high correlations among the subscale indices, although the condition number of bounds was 6.9, which is still under the critical value of 10.

Insert Table 3 about here

Backward Stepping Using Subscale Test Scores. The multiple regression equation using backward stepping is presented in Table 4. As with the complete regression model, cognitive attitude, awareness, locus of control, affective attitude and gender were the significant predictors of total commitment to computers. Unlike the complete regression model, application software skill was a significant, predictor. The R value of .59 was virtually identical with the complete model.

Insert Table 4 about here

Predicting Indices of Total Commitment. Since the three commitment subscales (use, interest, promotion) were highly correlated (Table 2) and showed similar correlation patterns with other independent variables, the presence of more than one statistically independent connection between the commitment indices and the independent variables was questioned. A canonical

correlation analysis was done incorporating the three commitment indices, as the dependent variable set, with attitudes, literacy, locus of control and gender, as the independent variable set. The analysis revealed only one major relationship among dependent and independent variables.

The first canonical variate accounted for almost 90% of the variance of the dependent variables. High correlations among the dependent and canonical variables indicated that all commitment indices were included in this canonical variate. Although two additional canonical variates were significant, the large amount of variance accounted for by the first covariate, suggested the presence of only one major canonical relationship. For this reason, multiple regression analysis was done on total commitment to computer use, and not on individual commitment subscales.

Discussion

The purpose of the study was to use structured and statistically reliable measures to assess the effectiveness of computer attitudes, literacy, locus of control and gender in predicting commitment to the use of computers.

Reliability and Theoretical Relevance

It is reasonable to conclude that the measures used in this study are statistically reliable, although any conclusions must be limited to the population assessed, namely student teachers in a large urban area. All measures showed high estimates of internal reliability and produced responses that were normally

distributed over the full range of possible values. Low correlations among dependent variables indirectly indicated that attitude, literacy and locus of control scales were not measuring the same factor. The theoretical relevance of the measures was supported by the effectiveness of different subscales to predict different aspects of commitment to the use of computers. The attempt to divide commitment into three separate indices was not supported statistically. Perhaps use, interest, and promotion of computers overlap too much to be practically and theoretically distinct with respect to the prediction of commitment to computers. A more in depth evaluation of these measures, including factor analyses and tests of construct validity, is required to fully assess theoretical integrity.

Predicting Commitment to Computers

Cognitive and, to a lesser extent, affective attitude were significant predictors of commitment to computers. Presumably enthusiasm for the use of computers is important for predicting commitment, but positive cognitions account for considerably more variance.

When compared to all other independent variable subscales, computer awareness was the only index of computer literacy that was a significant predictor of commitment. After eliminating non-significant factors (basic and programming skills), application skill was also a significant predictor. Practically speaking, application software skills probably should be considered when encouraging student teachers to support the use of computers in

schools.

Basic computer skills were not effective in predicting commitment. It is probably not necessary to assess these skills when trying to predict commitment to computers, especially since an assessment of application software ability implies a certain degree of proficiency in basic skills. Programming was also ineffective at predicting commitment to computers. This result provides indirect support for the claim that programming is a somewhat antiquated skill in the current realm of computer use in education.

Computer experience, although highly correlated with other indices of computer literacy, was not a significant predictor of commitment. The emphasis on frequency of computer experience as opposed to quality might explain this anomaly.

Locus of control was also significant predictor of commitment. Its relative contribution to the total commitment prediction equation was comparable to that of affective attitude and gender.

Being male was a significant, but minimal, predictor of commitment to computers. It is speculated that improving computer literacy skills, particularly in the areas of awareness and application software ability, could increase commitment to computers in females. Being male or female, then, does not have to determine one's destiny with respect to commitment to computers. Computer awareness and application software ability are more salient predictors.

Further Research

The assumption has been made in this study that commitment to the use of computers is directly linked to the acceptance and use of computers in the educational system. However, it has not been empirically tested. An assumption has also been made that one's intentions to partake in a behaviour parallel the actual behaviour. These assumptions could be tested using a pre-post test experimental paradigm.

Conclusion

This study has attempted to develop reliable and theoretically useful measures of attitudes, literacy, and locus of control, and to determine the effectiveness of these factors in predicting student teacher commitment to the use of computers in student teachers. It was found that positive cognitive attitudes, application software ability, awareness of computers, an internal locus of control, and being male were significant predictors.

REFERENCES

1. J. Wedman, and M. Heller, Concerns of teachers about educational computing, AEDS Journal, 18:1, pp. 31-40, 1984.
2. C.A. Sandeen, Teacher attitudes toward instructional innovations: Past, present, and future, International Journal of Instructional Media, 11:1, pp. 39-50, 1983-84.
3. N.A. Foell, A new concern for teacher educators: Computer literacy, Journal of Teacher Education, 34:5, pp. 19-22, 1983.
4. E. Galanter, Homing in on computers, Psychology Today, Sept., pp. 30-33, 1984
5. J. Hasset, Computers in the classroom, Psychology Today, Sept., pp. 22-28, 1985.
6. A. Molnar, The coming of computer literacy: Are we prepared for it?, Educational Technology, Jan., pp. 26-28, 1981.
7. L.A. Rhodes, On computers, personal styles, and being human: A conversation with Sherry Turkle, Educational Leadership, 43:6, pp. 12-16, 1986.
8. M.L. Waugh, and D. Currier, Computer-based education: What we know and need to know, Journal of Computers in Mathematics and Science Teaching, 5:3, pp. 13-15, 1986.
9. L. Dickerson, and W.H. Pritchard, Microcomputers and education: Planning for the coming revolution in the classroom, Educational Technology, 21:1, pp. 7-12, 1981.
10. A. Dittmer, Computer language literacy or litter, English Journal, 73:1, pp. 42-45, 1984.

11. R.W. Haigh, Planning for computer literacy, Journal of Higher Education, 56:2, pp. 161-171, 1985
12. C. Mosmann, Computer-based learning in higher education the missing revolution, Journal of Research and Development in Education, 14:1, pp. 69-78, 1981
13. I. Scheffler, Computers at school?, Teachers College Record, 87:4, pp. 513-528, 1986
14. M.S. Tucker, Computers in the schools: What revolution?, Journal of Communication, Autumn, pp. 12-23, 1985.
15. R. Ellsworth, and B.E. Bowman, "Beliefs about computers" scale based on Ahl's questionnaire items, The Computing Teacher, Dec, pp. 32-34, 1982
16. R.S. Lee, Social attitudes and the computer revolution, Public Opinion Quarterly, 34, pp. 53-59, 1970.
17. B.H. Loyd, C. Gressard, Reliability and factorial validity of computer attitude scales, Educational and Psychological Measurement, 44, pp. 501-505, 1984.
18. A. Pakula, Computers and Society: A Study of beliefs about the implications of the new technology, Unpublished Manuscript, 1984.
19. A. Durndell, H. Macleod, H., and G. Siann, A Survey of attitudes to, knowledge about and experience of computers, Computers and Education, 11:3, pp.167-175, 1987.
20. A. A. Koohang, A study of the attitudes of pre-service teachers toward the use of computers, Educational Communication and Technology, 35, pp. 145-149, 1987.

21. J.E. Woodrow, Educators' attitudes and predispositions toward computers, 6:3, pp. 27-37, 1987.
22. S.M. Chambers, and V.A. Clarke, Is Inequity Cumulative? The relationship between disadvantaged group membership and students' computing experience, knowledge, attitudes and intentions. Journal of Educational Computing Research, 3:4, pp. , 1987.
23. S.A. Smith, Computer attitudes of teachers and students in relationship to gender and grade level, Journal of Educational Computing Research, 3:4, pp. 479-495, 1987.
24. R.E. Anderson, T.P. Hansen, D.C. Johnson, and D.L. Klassen, Minnesota computer literacy awareness assessment (Tech. Rep), St. Paul Minnesota Educational Computing Consortium, 1979.
25. M.T. Battista, and K.J. Steele, The effect of computer-assisted and computer programming instruction on the computer literacy of high ability fifth grade students, School Science and Mathematics, 84:8, pp. 649-658, 1984.
26. G.G. Bitter, and S.J. Davis, Measuring development of computer literacy among teachers, AEDS Journal, 18:4, pp. 243-253, 1985.
27. E.B. Chapline, and S. Turkel, The impact of a computer literacy program on affective variables, Journal of Computers in Mathematics and Science Teaching, 5:3, pp. 30-33, 1986
28. T.T. Cheng, B. Plake, and D.J. Stevens, A validation study of the computer literacy examination: Cognitive aspect, AEDS Journal, 18:3, pp. 139-151, 1985

29. R.M. Gabriel, Assessing computer literacy: A validated instrument and empirical results, AEDS Journal, 18:3, pp. 153-171, 1985

30. R.M. Gabriel, Computer literacy assessment and validation: Empirical relationships at both student and school levels, Journal of Educational Computing Research, 1:4, pp. 415-425, 1985.

31. W.J. Jackson, D.G. Clements, and L.G., Computer awareness and use at a research university, Journal of Educational Technology Systems, 13:1, pp. 47-56, 1985

32. M.E. Lockheed, A. Nielsen, and M.K. Stone, Determinant of microcomputer literacy in high school students, Journal of Educational Computing Research, 1:1, pp. 81-96, 1985.

33. A. Luehrmann, Computer literacy What should it be?, Mathematics Teacher, Dec., pp. 682-686, 1981.

34. B.E. Wesley, G.H. Krockover, and C.R. Hicks, Locus of control and acquisition of computer literacy, Journal of Computer-Based Instruction, 12:1, pp. 12-16, 1985.

35. C.R. Morris, and E. Meyer, Early Child Development and Care, 32, pp. 101-118, 1988.

36. S. Arndt, J. Feltes, and J. Hanak, Secretarial attitudes towards word processors as a function of familiarity and locus of control, Behaviour and Information Technology, 2:1, pp. 17-22, 1983.

37. M.D. Coovert, and M. Goldstein, Locus of control as a predictor of users' attitude toward computers, Psychological Reports, 47, pp. 1167-1173, 1980.

38. P.A. Griswold, Differences between education and business majors in their attitudes about computers, AEDS Journal, 18:3, pp. 131-138, 1985.

39. K.W. Kerber, Attitudes toward specific use of the computer: Quantitative, decision-making and record-keeping applications, Behaviour and Information Technology, 2:2, pp. 197-209, 1983

Table 1

Internal Reliability Coefficients and Test Means for Computer Attitudes, Literacy, Locus of Control and Commitment (n=383)

	Reliability Coefficient	Mean	Standard Deviation
Interest in Computers	.89	30.1	12.3
Promotion of Computers	.91	32.9	12.1
Use of Computers	.91	33.2	12.4
Total Commitment	.96	96.2	34.9
Cognitive Attitudes	.89	71.8	13.6
Affective Attitudes	.91	96.6	16.5
Total Attitudes	.94	168.4	27.6
Basic Skills	.93	26.4	12.2
Application Software	.91	22.7	10.3
Computer Awareness	.90	21.5	9.3
Programming	.95	13.5	10.3
Computer Experience *	--	6.1	2.6
Total Computer Literacy	.97	90.3	39.5
Locus of Control	.86	62.0	14.5

* n=379

Table 2

Correlation Coefficients Among Total Test Scores for Dependent and Independent Variables

	Total	Intrst	Prmtn	Use	Att.	Comp.	Sex	Locus of Comm.	Lit.	Control
Tot. Comm.	1.0	.94	.95	.95	.61	.67	.22	.64		
Interest		1.0	.82	.84	.55	.60	.24	.58		
Promotion			1.0	.87	.63	.65	.19	.63		
Use				1.0	.57	.66	.21	.60		
Attitudes					1.0	.48	.03 *	.57		
Literacy						1.0	.28	.77		
Sex							1.0	.16		
Locus of Control								1.0		

Note. All correlations are significant at p<.001 except those with an asterix beside them.

* not significant

Table 3

Multiple Regression Equation Using Subscale Test Scores to Predict Commitment to the Use of Computers

Predictor	B weight	SE B weight	SRC	Sig. T
1. Cognitive Att.	.73	.12	.29	.0001
2. Awareness	.63	.23	.17	.0058

3.	Application Skills	.46	.30	.14 .1231
4.	Locus of Control	.29	.13	.12 .0319
5.	Affective Att.	.24	.10	.11 .0175
6.	Basic Skills	.27	.20	.09 .1912
7.	Gender	6.76	2.72	.09 .0134
8.	Programming	.19	.17	.06 .2708
9.	Comp. Experience	-.41	.68	-.03 .5500

R= .77 R-Squared =.59 SEE 22.6 F= 59.2 CNB=6.9 df=(9,369)

Note. Variables are listed in descending order SRCs

SE - Standard Error

SRC - Standard Regression Coefficient

SEE - Standard Error of Estimate

CNB - Condition Number of Bounds

Table 4

Backward Stepped Regression Equation Using Subscale Test Scores to Predict Commitment to the Use of Computers

Predictor	B weight	SE B weight	SRC	Sig. T
1. Cognitive Att.	.72	.12	.28	.0001
2. Application Skills	.73	.21	.22	.0006
3. Awareness	.64	.22	.17	.0035
4. Locus of Control	.32	.13	.13	.0152
5. Affective Att.	.26	.10	.12	.0104
6. Gender	7.91	2.60	.11	.0025

R= .77 R-Squared =.59 SEE 22.6 F= 88.4 CNB=3.5 df=(6,372)

Note. Variables are listed in descending order SRCs

SE - Standard Error

SRC - Standard Regression Coefficient

SEE - Standard Error of Estimate

CNB - Condition Number of Bounds