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AUTHOR Moroz, Pauline A.; Nash, John B.
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ABSTRACT

The Bath County Computer Attitude Scale (BCCAS) has received limited attention concerning its reliability and validity with a U.S. adult population. As developed by G. G. Bear, H. C. Richards, and P. Lancaster in 1987, the instrument assessed attitudes toward computers in areas of computer use, computer-aided instruction, programming and technical issues, social issues, and computer history. This study addressed the lack of information about this measure by examining the scale's factorial structure and its convergent validity with the four-scale version of the Computer Attitude Scale developed by B. H. Loyd and D. E. Loyd (1985). Using data from 222 graduate education students, a principal factor analysis with varimax rotation generated a 5-factor solution, with 3 factors showing promise. Results also show that the BCCAS correlates with computer confidence, anxiety, liking, and perceived usefulness of computers. The BCCAS was found to be internally consistent, predictive of a range of attitudinal domains toward computers, and of questionable unidimensionality. (Contains 2 tables and 12 references.) (Author/SLD)

Bath County Computer Attitude Scale: A Reliability and Validity Study

Pauline A. Moroz
The University of Texas at El Paso
504 EDUC
El Paso, TX 79968
(915) 747 5783
pmoroz@utep.edu

John B. Nash
The University of Texas at El Paso
501 EDUC
El Paso, TX 79968
(915) 747 7614
john@utep.edu

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Abstract

The Bath County Computer Attitude Scale (BCCAS) has received limited attention in terms of it's reliability and validity with an American adult sample population. This study sought to address this imbalance by examining the factorial structure of the BCCAS and it's convergent validity with the four-scale version of the Computer Attitude Scale. Using data from 222 graduate education students, a principal factor analysis with varimax rotation generated a five-factor solution; three of which showed promise. Results of this study also showed that the BCCAS correlates with computer confidence, anxiety, liking, and perceived usefulness of computers. In conclusion, the BCCAS was found to be internally consistent, predictive of a range of attitudinal domains towards computers, and of questionable unidimensionality.

Microcomputers continue to proliferate in American public schools. In 1995 there was an average of 72 computers in every public school in the United States (National Center for Educational Statistics, 1996) and the numbers are expected to increase. Whilst there is broad consensus that the number of computers in many schools is adequate, concerns are now centered on best practices for implementation of the equipment and its related technologies, and understanding potential barriers to that implementation. Recent focus has been placed upon understanding the attitudes of educators toward computers, thus the validity and reliability of computer attitude measures becomes more paramount. The purpose of this study is to assess the psychometric properties of the Bath County Computer Attitude Scale.

Bath County Computer Attitude Scale

Developed by Bear, Richard's, and Lancaster (1987), the initial version of the Bath County Computer Attitude Scale (BCCAS) consisted of thirty-eight likert-type items designed to assess attitude towards computers in five areas: general computer use, computer-aided instruction, programming and technical concepts, social issues surrounding computer use, and computer history. The questionnaire includes both positively and negatively worded items (e.g., "I wish I had more time to use computers in school"; "studying about computers is a waste of time"). In a pilot study, the scale was administered to 392 students in grades four through twelve, in three rural schools in West Virginia. This sample was divided into two groups: a younger group consisting of 200 children in grades four through six; and an older group of 150 twelfth through seventh graders. Varimax and oblimin solutions were conducted on the data sets, but no meaningful structures were found. As a result, Bear et al. reported that the BCCAS was unidimensional in nature. The questionnaire was reduced in length through the selection of twenty-six items with the highest item-total correlation's (coefficient alpha reported as .94). The revised version of the BCCAS was validated in 1985 with 276 boys and 175 girls in grades 4 ($\underline{n}$ = 54); 5 ($\underline{n}$ = 47); 6 ($\underline{n}$ = 96); and 7 ($\underline{n}$ = 80). Two instruments were used to confirm the validity of the BCCAS: a six item survey covering such topics as computer usage and experience, educational and career plans, and favourite school subjects; and the Elementary Form of the Estes Attitude Scales- a measure of

attitudes towards school subjects, focusing on reading, mathematics, and science (Estes, Estes, Richards, and Roettger, 1981). Bear et al. found that a positive, but low-level, relationship existed between computer attitude and self-reported computer experience and usage. Additionally, those respondents who planned to learn more about computers and enter a computer-related career held more positive attitudes than those who did not; as did those students who selected computer science or science as their favourite subjects. Finally, Bear et al. report all correlation's with The Estes Attitudes Scales as 'favourable' (for example, $\underline{r} = .50$, $\underline{p} < .01$, $\underline{n} = 53$ fifth graders). Bear et al. use these findings to support their claim that the BCCAS is a valid and reliable instrument.

The BCCAS has also been found to differentiate between career decisions made by South African high school students. A study by Pike, Hofer, and Erlank in 1993 found that school-leavers who were intent on entering computer-related professions held more positive attitudes towards computers than other school-leavers.

More recently, Francis and Evans (1995) presented reliability and validity evidence for the BCCAS through comparisons of the BCCAS with five independent measures. In this study, Francis and Evans administered the BCCAS to 387 undergraduate students in the United Kingdom and found the internal consistency to be $\underline{r} = .95$. The Pearson product moment correlation coefficient with three of the four Computer Attitude Scale subscales [6] was reported as $\underline{r} = .8$. Curiously, Francis and Evans confirm the unidimensionality of the BCCAS with an unrotated principal component analysis.

Whilst these studies provide valuable psychometric information about the BCCAS, none have utilized adult American samples. Bear et al. (1987), for example, used school aged children; as did Pike et al. (1993) in South Africa. Francis and Evans (1995) collected data from British adults (71% of whom were under the age of 20). As Bear et al. and Francis and Evans note, further studies should be conducted among other age groups in order to confirm the usefulness of the BCCAS. Thus, the present study builds on previous research into the reliability and validity of the BCCAS by using data collected from an adult American population. In an attempt to replicate, in part, the Francis and Evans study, concurrent validity of the BCCAS was examined through the

empirical comparison of the BCCAS with Loyd and Loyd's Computer Attitude Scale (1985). The present study, however, utilizes the full length four subscale version of the CAS. Also, an exploratory principal component analysis with varimax rotation was conducted to assess the unidimensionality of the scale.

Instrumentation

Bath County Computer Attitude Scale

In its original form, the BCCAS was a three point likert style questionnaire. For the present study, however, a five point scale was employed in order to maintain consistency with the Francis and Evans study of the BCCAS, and the typical CAS item response reports: 1 = Strongly Disagree; 2 = Disagree; 3 = Not Sure; 4 = Agree and 5 = Strongly agree. Scores for the BCCAS were computed by adding the total number of item response scores. Scores for thirteen negatively worded items of the BCCAS were reversed before summing.

Computer Attitude Scale

Loyd and Loyd's Computer Attitude Scale (CAS) (1985) is a well known and respected measure of attitudes towards computers (Gardner, Discenza, and Dukes, 1993). As a likert-type instrument, it consists of 40 items covering four computer attitude domains: (1) an anxiety or fear of computers; (2) confidence in one's ability to use or learn about computers; (3) a liking or enjoyment of working with computers; and (4) perceived usefulness of computers in present or future work. Each subscale contains negatively and positively worded items. Loyd and Gressard (1986) report coefficient reliabilities as .90, .89, .89, and .82 for each of these four subscales. In addition to the studies by the principal developers, the four subscale version of the CAS has received additional favourable psychometric investigations from Christensen and Knezek (1996), Kluver, Lam, Hoffman, Green, and Swearingen (1994), and Roszkowski, Devlin, Snelbecker, and Jacobsohn (1988).

Methodology

Sample

Data for the study was collected from 222 graduate education students at a large

southwestern university. Both the BCCAS and CAS were voluntarily completed during class time. The sample included 155 females and 61 males (8 were unknown); 72% were aged 30 or older (34% in their thirties, 26% in forties, and 12% fifty or older).

General Procedures

The sample were administered the BCCAS and CAS subscales at the beginning of graduate education-related courses. Item responses were coded so that a higher score indicated a more positive attitude towards computers. Data was analyzed by means of SPSS (1995); a 26 X 26 matrix was formed and subjected to principal component analysis. In order to achieve simple structure, the BCCAS factorial structure was subjected to a varimax rotation; the exploratory factor analysis was conducted with eigenvalues of one or higher. Pearson product moment correlation coefficients were computed to ascertain the interrelationships among the BCCAS and the CAS subscales. A reliability analysis, in the form of Cronbach's alpha, was conducted to determine the internal consistency of the BCCAS.

Results

The mean and standard deviation for the BCCAS was 106 and 14 respectively. The computed Cronbach's coefficient alpha revealed an internal consistency of $\underline{r} = .93$ for the 26-item BCCAS. A principal component analysis with varimax rotation unveiled a five factor solution that accounted for 59 percent of the variance. Table 1 depicts the five factors and factor pattern structure coefficients, along with the common factor variance for each item ($\underline{h}^2$). Factor I consisted of twelve items, accounted for most of the covariance (39.6%), and had factor pattern structure coefficients ranging from .53 to .77. Factor II consisted of 6 items with coefficients from .40 to .72. The third factor was defined by four items (factor pattern structure coefficients from .42 to .81). Factor IV consisted of three items, while Factor V was defined by one: "people who use computers are often odd".

Table 2 presents the Pearson product moment correlation coefficients between the BCCAS and the CAS subscales. Correlation's were noted as .78, .83, .76, and 77 with the Computer Confidence, Computer Liking, Computer Anxiety, and Computer Usefulness subscales. The

Table 1
Five Factor Varimax-Rotated Solution and Communalities for the Bath County Computer Attitude Scale (N = 222).

Item Description	Factor Pattern/Structure Coefficients					
	I	II	III	IV	V	h^2
I enjoy using a computer	.76	.11	.7	.12	.10	.63
It is fun to figure out how computers work	.68	.06	.19	.38	-.01	.64
Working on a computer is a good way to spend spare time	.56	.28	.10	.32	.01	.50
I enjoy learning how computers are used in our daily lives	.69	.30	.15	.16	-.09	.63
Computers are not exciting	.61	.52	.10	.14	.26	.74
Using a computer becomes boring after about half an hour	.65	.33	.15	.06	.10	.57
Working math problems on a computer is fun, like solving a puzzle	.54	.03	.15	.48	.07	.55
I wish I had more time to use computers in school	.59	.29	.16	.20	-.09	.50
Learning about computers is interesting	.77	.26	.19	.20	.10	.74
Learning about computer hardware and software is fun	.74	.15	.29	.21	.01	.70
Learning about the different uses of computers is interesting	.65	.37	.27	-.04	-.05	.64
It is easy to get tired of using a computer	.53	.17	.32	.24	.20	.51
Reading and talking about how computers might be used in the future is boring	.29	.56	.39	-.10	.26	.62
Computers are boring	.40	.59	-.07	.07	.21	.57
Classroom discussions about the use of computers in society are a waste of time	.20	.71	.19	.23	-.09	.65
Learning about computers is something I can do without	.39	.40	.10	.13	.13	.37
People who use computers in their jobs are the only people who need to study about computers	.13	.62	.07	.25	-.06	.50
Studying about computers is a waste of time	.31	.55	.26	.34	.02	.58
Studying about the history of computers is boring	.17	.16	.81	.07	.08	.73
Studying about the uses and misuses of computers will help me be a more responsible citizen	.32	.19	.42	.02	-.40	.47
Learning abut the development of computers is interesting	.34	.13	.70	.10	-.02	.63
Learning to program a computer is something I can do without	.15	-.02	.61	.51	.19	.69
Computers can help people to think	.31	.24	.11	.53	-.09	.45
School would be a better place without computers	.16	.46	-.28	.56	.16	.65
Studying computer science in high school would be a good idea	.18	.25	.16	.53	-.01	.40
People who use computers are often odd	.14	.13	.14	.04	.80	.71

Table 2
Descriptive Statistics and Intercorrelations Among the Bath County Computer Attitude Scale and Computer Attitude Scales.

Subscale	n	M	SD	BCCAS	1	2	3	4
BCCAS	224	106	14	(.93)				
Computer Attitude Scale	179	163	24	.89 79%				
1 Computer Confidence	223	41	6	.78 61%	(.90)			
2 Computer Liking	222	40	8	.83 69%	.74 55%	(.79)		
3 Computer Anxiety	221	41	7	.76 58%	.91 83%	.75 56%	(.92)	
4 Computer Usefulness	182	43	5	.77 59%	.71 50%	.72 52%	.71 50%	(.82)

Notes. Cronbach's coefficient alpha reported in parentheses. All correlation's are statistically significant at $p<.001$. Percentage of explained variability (r^2) reported in subscript.

BCCAS correlated with the CAS in its entirety at .89. Interestingly, an Independent measures t test revealed no significant difference in mean scores between males and females (t (214) = .65, p = .516). These findings concur with other research conducted with the BCCAS (Francis, and Evans, 1995; Pike, Hofer, and Erlank, 1993; Pope-Davis, and Twing, 1991; Bear, Richards, and Lancaster, 1987).

Discussion and Conclusions

The purpose of this study was to explore the reliability and validity of the BCCAS. More specifically, this study extended previous research of the BCCAS by comparing data gathered from a sample of American adults with the four subscale version of the CAS. Bear et al.(1987), the original authors of the BCCAS, had deemed the BCCAS to be unidimensional; however, with an absence of the dispersion of factor pattern/structure coefficients in their article, it is impossible to clarify their determination. Francis and Evans (1995) used a sample of young British adults, but failed to rotate their principal component analysis; thus providing unclear information regarding the instruments dimensionality with an adult population. With an American adult sample, this study yielded five factors, three of which were promising (these three accounted for 50.7 percent of the variance).

Nonetheless, attempts at interpreting these factors were unfruitful. Factor I suggested general computer interest, while Factor II appeared to represent computer negativism. Factor III reflected computer ancillary/supplementary computer knowledge, with Factor IV reflecting computer benefits. The final factor, Factor V, comprising of just one item, was clearly uninterpretable. This present study agrees with Bear et al. (1987) in that the instrument failed to generate a pattern of factor structure coefficients with an interpretable simple structure. However, a meaningless structure does not merit a conclusion of unidimensionality.

Results of this study also show that the BCCAS correlates with computer confidence, anxiety, liking, and perceived usefulness of computers. In conclusion, the BCCAS was found to be internally consistent, predictive of a range of attitudinal domains towards computers, and of questionable unidimensionality.

Convergent validity with the CAS (1985) and its subscales reveal that the BCCAS as a whole measures attitude towards computers. The strong convergent validity measures suggest that the BCCAS can measure overall attitude towards computer—the specific composites of which remain a mystery. To say that the BCCAS is unidimensional may be inappropriate. It remains to be seen, however, how these factors bear out in subsequent studies. Kerlinger (1986) urges the replication of factor analytic studies, especially those utilizing different and large samples. Thus, it is recommended that future research focus on larger samples of both adults and children. It is possible that for the adult population used in this study, the BCCAS may differentiate the subtleties of attitude towards computers, rather than with child populations used in the previous studies. It may be that adults are more exposed to the vagaries of the utility of computers than are children, and hence factor patterns may emerge.

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Sign here→ please Signature: PM Moroz	Printed Name/Position/Title: P Moroz Assist Coord for Evaluation	
Organization/Address: UTEP Challenge Grant, 501 EDB El Paso, TX 79968	Telephone: 915 747 5783	FAX: 915 747 5355
	E-Mail Address: pmoroz@utep.edu	Date: 25 Mar 97

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