JAEPR, 3(*2*),
Copyright © 2017,
ISSN: 1930-9325

RESEARCH ARTICLE

Preliminary Analysis of Technical Characteristics of the *Basic Technology Competencies for Educators Inventory*-Revised

Patricia Wilkins, Claudia P. Flowers, and Bob Algozzine

University of North Carolina at Charlotte

The purpose of the present study was to update and evaluate technical characteristics of a self-report measure of technology skills and abilities (i.e., the *Basic Technology Competencies for Educators Inventory-Revised* [BTCEI-R]). Undergraduate and post-baccalaureate teacher education majors provided data for analysis. The principal component analysis supported the theoretical structure of the 10 components hypothesized in the design. The before and after instruction study supported the predicted change that would be expected after instruction in basic technology, with large effect sizes. The internal consistency reliability coefficients indicated a high level of homogeneity within components and across scores on all items of the measure, which will result in consistent scores. The results of this study support the use of the BTCEI-R for measuring educators' technology competencies.

Keywords: Basic technology competencies, educators, validity and reliability.

Most people agree that technology has rapidly changed everyday lives. For example, "we shop online, download news in our iPods, communicate via text and video, take digital photos, and conduct all manner of personal and professional business via the Internet" (Smolin & Lawless, 2007, p. 1); and, information and communication technologies (ICT) have created significant opportunities for teachers and other education professionals to rethink what it means to be digitally literate in the 21st century (Anderson & Dexter, 2005; Coiro, Knobel, Lankshear, & Leu, 2008; Hughes, McLeod, Dikkers, Brahier, & Whiteside, 2005; Stobaugh & Tassell, 2011; UNESCO, 2002a,b; Willis, 2006). Historically, in education, the computer was heralded as a powerful tool to support learning; and, more recently, investments in educational hardware and software have shifted the focus and value of technology, albeit often unrealized, to benefits associated with increased productivity as well (Abbitt, 2011; Archer, 1998; Borthwick, Pierson, Anderson, Morris, Lathem, & Parker, 2004; Bowes, & D'Onofrio, 2006; Lawless & Pellegrino, 2007; Li, 2007; Stobaugh & Tassell, 2011; Turner, 2005).

Clearly, for technology to be effective, educators require basic skills and abilities to fully integrate it into the workplace not only as elements of instructional delivery but also as a productivity enhancer for working smarter, not harder (Cuban, 2001; Guzman & Nussbaum, 2009; Lawless & Pellegrino, 2007; Stobaugh & Tassell, 2011). Given the importance of technology use and competencies in classrooms, most professionals agree that training programs need to closely monitor both entering and exiting competencies of their beginning and experienced teachers and that employers can benefit from a measure that supports entry-level assessment of basic technology skills and abilities (Doherty & Orlofsky, 2001; Guzman & Nussbaum, 2009; Lawless & Pellegrino, 2007; Martin & Dunsworth, 2007; Sprague, Kopman, & Dorsey, 1988; Stuhlman, 1998; Topper, 1998, 2004; UNESCO, 2002a,b).

With regard to professional development content, Hazari (1991) introduced a structure for training in educational technology that included awareness, development of skills, and application of knowledge as key features. More recently, using a review of 5 position papers and 26 studies, Guzman and Nussbaum (2009) described 6 "domains and competencies linked to teacher training propositions for technology integration," including "instrumental/technological, pedagogical/curricular, didactic/methodological, evaluative/investigative, communicational/relational and personal/attitudinal" (p. 453). Stobaugh and Tassell (2011) found that university students "are getting what they need" relative to "learning 'about' technology;" however, they found that both "learning 'from' technology" and "learning 'with' technology" remain unfulfilled goals (p. 156). While application (e.g., why, when, where, and how) is always the ultimate goal of using ICT in the classroom, novice and experienced teachers need awareness of and competence in basic skills before they can apply what they know in improving their personal and professional practices. From this base, we reasoned that the assessment of basic technology competencies was useful in planning, delivering, and evaluating technology-based instructional content for preservice and inservice teachers.

PLANNING AND PROVIDING ICT PROFESSIONAL DEVELOPMENT

The literature is well-documented with competences that educators believe teachers should have in the digital age. For example, members of an international leadership organization believe that professional development for teachers should focus on why, when, where, and how technology contributes to instruction and how to effectively choose from and use a broad range of ICT tools (cf. UNESCO, 2002b). Turner (2005) described professional development areas of knowledge and skill and websites for "helpful information and tutorials" related to word-processing, spreadsheets, databases, electronic presentations, Web navigation, e-mail management, storage devices and other media, file management, PDAs, copyright, and computer security. Martin and Dunsworth (2007) opined that some of the new computer literacy skills are electronic gaming, synchronous and asynchronous communication, weblogs, webpages, and multimedia text production. Arguing that the critical professional development issue was not "whether or not technology should be used in the classroom" but more "ensuring that teachers use technology effectively to create new opportunities for students to learn and raise their achievement," Aduwa-Ogiegbaen (2009) found that the majority of "inservice teachers lacked competencies in core technology areas" and that when surveyed they all indicated that they need extensive training in ICT skills and competencies such as word processing, electronic presentation, Internet navigation (p. 17).

Clearly, expectations are that twenty-first-century teachers develop skills to maximize their use of the computer as a teaching resource that supports learning and prepares their students to achieve in modern, high-tech societies (Carlson & Firpo, 2001; Guzman & Nussbaum, 2009;

Ministerial Advisory Council on the Quality of Teaching, 1995; Tapscott, 1999; Turner, 2005; UNESCO, 2002a,b, 2008a,b,c). To achieve this, there is a continuing need for preparation on ICT knowledge and skills that support confidence, effective, and efficient classroom use (Abbit, 2011; Charles, 2010; Coiro et al., 2008; Kabilan, 2004; Turner, 2005; U. S. Department of Education, 2008); and, the extent to which technology "training" is infused into existing courses or offered in separate courses, there is a persistent and growing interest and need for assessing the ICT knowledge, beliefs, and attitudes of teachers and other professionals (Abbitt, 2011; Abbitt & Klett, 2007; Aduwa-Ogiegbaen, 2009; Doering, Scharber, & Miller, 2009; Keating & Evans, 2001; Wang, Ertmer, & Newby, 2004).

In previous work (Flowers & Algozzine, 2000), we reported on the development and technical adequacy of a measure of basic technology competencies for educators (i.e., the *Basic Technology Competencies of Educators Inventory*). The purpose of this research was to update and provide preliminary psychometric data for the *Basic Technology Competencies of Educators Inventory-Revised* (BTCEI-R).

METHOD

Participants

We completed our study using two groups of preservice and inservice teachers. Both samples were consistent in demographic composition with those in similar instrument development and related technology competency research and evaluation studies (cf. Abbitt, 2011; Aduwa-Ogiegbaen, 2009; Guzman & Nussbaum, 2009; Pishghadam, Noghani, & Zabihi, 2011; Topper, 2004; Wang, Ertmer, & Newby, 2004).

The participants for the development study were 83 undergraduate (42%), graduate (51%) or post-baccalaureate (7%) students enrolled in an introductory education course at a large university located in the southeast United States. The course was required for students in the initial teacher licensure program at the university. The sample was predominantly single (60%) women (80%) from Caucasian ethnic backgrounds (75%) with an average number of years of teaching experience of 6.72 years (SD = 7.13, Minimum = 0, Maximum = 27).

The participants for the pretest/posttest comparison study were 37 students enrolled in an introductory education course, required for students in the instructional technology program, at the same university as those in the development study; and, undergraduate (19%), graduate (70%) or post-baccalaureate (11%) students were included. The sample included both single and married students (49%, respectively), mostly women (76%), and Caucasian (70%), African-American (19%), and Hispanic (3%) ethnic backgrounds. The average number of years of teaching experience of the sample was 6.72 years (SD = 7.13, Minimum = 0, Maximum = 27).

Scale Development and Revision

Items for the original instrument were developed though consulting the literature and a review of the fundamental concepts and skills established by professional organizations focused on information and communication technologies (Flowers & Algozzine, 2000). A panel of faculty with expertise in the field of educational technology selected four skills representing a progression from simple to complex within each domain including items representing National Educational Technology

Standards for Teachers (NETS-T; ISTE, 2008). The continued relevance for inclusion of original items in the revised instrument was confirmed with an updated analysis of the literature and review of the current technology standards for teachers established by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the International Society for Technology in Education (ISTE). Each domain included an item that required respondents to evaluate their overall skill level for that domain. Items were ordered contiguously by skill areas after pilot-testing revealed the following minor difficulties: Time to complete the scale was less than optimal, students reported problems thinking about ungrouped groups of items, and the conceptual nature of the "competency areas" was lost. While limiting factors associated with the contiguity (e.g., practice effects, effects of fatigue) were valued, the counterbalancing benefits of clustering justified the decision to keep similar items together. The items and domains (as represented in the scale) are presented in Appendix A.

All items used a four-point scale: Not competent (1 point), somewhat competent (2 points), competent (3 points), and very competent (4 points). Similar to the original scale, the following clarifying information was included to aid participants in choosing the correct response option: Not very competent individuals cannot consistently perform the task independently; somewhat competent individuals can perform task with assistance; competent individuals can consistently complete the task independently; and, very competent individuals can teach others how to perform the task.

Data Analyses

All analyses were performed using the IBM® SPSS® (IBM, 2012) computer software. We obtained descriptive statistics (i.e., means, standard deviations, and correlations) for items and subscales in the BTCEI-R. We believed an underlying structure would explain a predictable portion of the variance observed in the checklist ratings of our participants and used confirmatory factor analysis procedures to assess construct validation. Accepting that "there is no compelling analytical reason to favor one rotational method over another" (Hair, Anderson, Tatham, & Black, 1998, p. 110), we documented the decrease in eigenvalues (i.e., scree test) values to a relatively uniform level (i.e., less than 1.0) to confirm our 10-factor solution and retained an orthogonal rotation (varimax) for interpretation (cf. Cliff & Pennell, 1967; Eaves, Rabren, & Hall, 2012; Field, 2009; Gorsuch, 1983; Pennell, 1968). We also completed a quasi-experimental comparison to evaluate the sensitivity of BTCEI-R scores over the course of an academic semester in which students participated in a course designed to improve their instructional technology competencies. To compute effect sizes (ESs) on improvement scores, we calculated the difference between the means and divided it by the pooled standard deviation of the improvement/square root of $2(1 - r_{xy})$ (cf. Glass, McGaw, & Smith, 1981; Morris & DeShon, 2002). We used internal consistency analyses to provide evidence of reliability of BTCEI-R scores.

RESULTS

Means, standard deviations, and ranges for BTCEI-R items and subscales are in Table 1. Across all 10 domains, the mean item values within the domains decreased as the domain competencies became more complex. For example, within the *Spreadsheet Management* domain the competency of *Enter data in cells* had a mean value of 3.01 with the remaining competencies decreasing in value. The trend in the data supports the ordering of the competencies by complexity level.

TABLE 1
Means, Standard Deviations, and Ranges for BTCEI-Revised

Domain/Item	M	SD	Range	
			Lo	Hi
Setup, Maintenance, and Troubleshooting of Equipment (1-5)				
Connect peripheral devices (printer, camera, scanner) (3)	3.17	0.76	1	4
Backup files (CD, flash drive, hard drive, other media) (1)	3.12	0.85	1	4
Use virus protection software (2)	2.48	0.96	1	4
Run defragmenter or other system tools on hard drive (4)	2.11	1.01	1	4
Word Processing (6-10)				
Change font size, type, and style (7)	3.82	0.42	2	4
Cut, copy, and paste within and between documents (8)	3.81	0.45	2	4
Insert files, graphics, and tables in documents (9)	3.45	0.70	1	4
Set margins and insert header, footer, and/or page numbers in documents (6)	3.34	0.79	1	4
Spreadsheet Management (11-15)				
Enter data in cells (11)	3.01	1.02	1	4
Move data within and between spreadsheets (12)	2.59	1.11	1	4
Create charts (14)	2.36	1.01	1	4
Use formulas (13)	2.12	1.03	1	4

Database Management (16-20)				
Enter data in a database (16)	2.23	1.06	1	4
Sort, filter, and search in a database (17)	2.11	1.05	1	4
Produce a report and/or run a query in a database (18)	1.76	0.97	1	4
Merge database information into word processing document (19)	1.65	0.96	1	4
Desktop Publishing (21-25)				
Insert clipart, text, graphics, and other images (23)	3.11	0.92	1	4
Change text, margins, tabs, spacing, and other formatting options (22)	2.92	0.95	1	4
Find and use templates (21)	2.61	0.96	1	4
Create and distribute electronic newsletters (24)	2.42	1.01	1	4
Networking (26-30)				
Log on a network (26)	3.30	0.87	1	4
Work in a network environment (27)	3.10	0.81	1	4
Share files electronically via the network (28)	3.01	0.94	1	4
Use blogs and/or wikis or other social/professional networks (29)	2.82	1.01	1	4
Telecommunication (31-35)				
Send and receive E-mail and attachments (31)	3.76	0.46	2	4
Use of instant and/or text messaging (33)	3.65	0.57	2	4

Locate research and teaching resources using the Internet (32)	3.40	0.73	1	4
Use of videoconferencing software (Skype, Adobe Connect, WebEx, etc;) (34)	2.87	1.07	1	4
Media Communication (36-40)				
Develop a presentation including text, graphics, and sounds (38)	3.00	0.88	1	4
Use a document camera (image presenter, digital overhead, docucam) (36)	2.88	0.90	1	4
Develop an interactive electronic slide show (37)	2.69	0.96	1	4
Develop a podcast (39)	1.52	0.80	1	4
Social, Legal, and Ethical Issues (41-45)				
Share knowledge and abide by copyright laws and fair use guidelines (41)	2.84	0.93	1	4
Share knowledge and abide by intellectual property rights (43)	2.72	1.02	1	4
Share knowledge and abide by shareware regulations (42)	2.57	1.01	1	4
Share knowledge about software piracy (44)	2.54	1.09	1	4
National Educational Technology Standards (NETS) (Items 46-51)				
Understand issues and responsibilities in an evolving digital culture (49)	2.49	0.92	1	4
Use contemporary tools and resources to maximize content learning (47)	2.47	0.82	1	4
Advance student learning in both face-to-face and virtual environments (46)	2.45	0.83	1	4
Promote and demonstrate effective use of digital tools and resources (50)	2.42	0.91	1	4
Exhibit knowledge and skills of an innovative professional in digital society (48)	2.31	0.88	1	4

Overall rating of *word processing* (10)	3.47	0.61	2	4
Overall rating of *telecommunication* (35)	3.27	0.70	2	4
Overall rating of *networking* (30)	2.90	0.92	1	4
Overall rating of *desktop publishing* (25)	2.66	0.83	1	4
Overall rating of *social, legal, and ethical issues* (45)	2.58	0.98	1	4
Overall rating of *media communication* (40)	2.49	0.82	1	4
Overall rating of *setup, maintain, and troubleshoot equipment* (5)	2.48	0.79	1	4
Overall rating of *NETS* (51)	2.39	0.84	1	4
Overall rating of *spreadsheet management* (15)	2.33	0.91	1	4
Overall rating of *database management* (20)	1.89	0.95	1	4

Note. 1 = Not very competent (cannot consistently perform the task independently); 2 = somewhat competent (can perform task with assistance); 3 = competent (can consistently complete the task independently); and, 4 = very competent (can teach others how to perform the task). Numbers in parenthesis represent item placement in original scale.

A matrix of the Pearson product-moment correlation coefficients among the 10 domain scores is reported in Table 2. All but one of the correlation coefficients (i.e., $r_{\text{telecommunication/social, legal, and ethical issues}} = .15$) were statistically significant ($p < .01$) and ranged from .25 to .62. This suggests that the domains are measuring different constructs, but have some common shared variance.

TABLE 2
Inter-correlations between Subscales on the BTCE-R

Subscale	2	3	4	5	6	7	8	9	10
1	.39	.44	.44	.48	.47	.25	.44	.33	.47
2		.40	.32	.44	.58	.56	.36	.34	.50
3			.60	.45	.49	.25	.40	.36	.36
4				.50	.34	.28	.46	.25	.37
5					.63	.35	.55	.31	.52
6						.51	.55	.47	.62
7							.45	.15	.45
8								.42	.54
9									.44

Note. 1 = Setup, maintenance, and troubleshooting of equipment, 2 = word processing, 3 = spreadsheet maintenance, 4 = database management, 5 = desktop publishing, 6 = networking, 7 = telecommunication, 8 = media communication, 9 = social, legal, and ethical issues; 10 = National Educational Technology Standards.

Validity

A principal component analysis (PCA) was conducted on the 51 items with orthogonal rotation (varimax). The obtained Kaiser-Meyer-Olkin index (Kaiser, 1974) supported the adequacy of the sample, *KMO* = .78, and all but one (i.e., Item 1 = .49) of the *KMO* values for individual items were above the acceptable level of .50 (cf. Field, 2009; Gorsuch, 1983; Hutcheson & Sofroniou, 1999; Tabachnick, & Fidell, 2001). Bartlett's test of sphericity, $\chi^2(1275) = 4722.39$, $p < .05$, indicated that inter-item correlations were sufficiently large for PCA. The results of the PCA indicated that 10 components had eigenvalues greater than 1.0, which corresponds to the number of hypothesized components (see Figure 1). The resulting components in combination explained 80.65% of the variance. The pattern coefficients and communalities from this analysis are presented in Table 3. The communalities ranged from .55 to .95, suggesting all items shared common variance with the rest of the items. Pattern coefficients greater than .50 were used to determine relationships between the items and the component, with values less than .50 not displayed in the Table. The *a priori* hypothesized associations of items with components were supported by the data, except for "*Use formulas*" of the Spreadsheet Management items which had a pattern coefficient of .54 with the

Database Management domain and "*Develop presentation including text, graphics, & sounds*" which had a pattern coefficient less than .50 with the *Telecommunication* domain. The results support a simple structure, indicating that items are highly related to the hypothesized component and not related to other components.

FIGURE 1
Scree plot

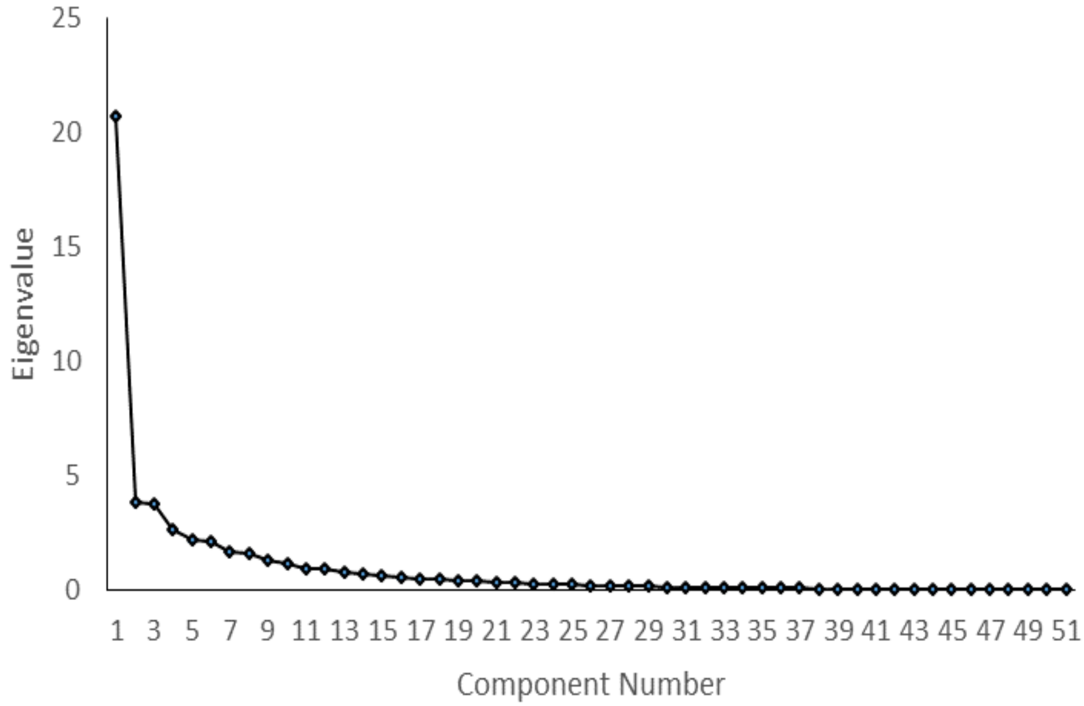

TABLE 3
Rotated Factor Pattern Matrix for the BTCEI-R

	Factor Loading										
Item	I	II	III	IV	V	VI	VII	VIII	IX	X	σ^2_c[a]
Backup files (CD, flash drive, hard drive, other media)								.71			0.72
Use virus protection software								.78			0.77
Connect peripheral devices (printer, camera, scanner)								.52			0.71
Run defragmenter or other system tools on hard drive								.64			0.60
Setup, maintain, and troubleshoot equipment								.72			0.78
Set margins and insert [other features] in documents						.68					0.72
Change font size, type, and style						.93					0.93
Cut, copy, and paste within and between documents						.91					0.91
Insert files, graphics, and tables in documents						.58					0.83
Word processing						.65					0.77
Enter data in cells					.77						0.74
Move data within and between spreadsheets					.71						0.81
Use formulas		.53			.57						0.71
Create charts					.71						0.78

Item	Factor Loading I	II	III	IV	V	VI	VII	VIII	IX	X	σ^2_c [a]
Spreadsheet management					.75						0.86
Enter data in a database		.69									0.79
Sort, filter, and search in a database		.76									0.87
Produce a *report* and/or run a *query* in a database		.85									0.90
Merge database info into word processing document		.83									0.82
Database management		.87									0.91
Find and use templates				.76							0.85
Change [formatting options]				.79							0.84
Insert clipart, text, graphics, and other images				.74							0.76
Create and distribute electronic newsletters				.67							0.73
Desktop publishing				.80							0.90
Log on a network									.70		0.84
Work in a network environment									.68		0.85
Share files electronically via the network									.61		0.84
Use [social/professional networks]									.59		0.80
Networking									.67		0.93
Send and receive E-mail and attachments							.53				0.61
Locate research and teaching resources using Internet							.60				0.65
Use of instant and/or text messaging							.77				0.68
Use of videoconferencing							.63				0.74
Telecommunication							.76				0.84
Use a document camera										.57	0.58
Develop an interactive electronic slide show										.75	0.83
Develop presentation including text, graphics, & sounds										.63	0.80
Develop a podcast											0.55
Media communication										.66	0.82
Share knowledge & abide by copyright laws…			.87								0.84
Share knowledge & abide by shareware regulations			.91								0.94
Share knowledge & abide by intellectual property rights			.92								0.91
Share knowledge about software piracy			.87								0.91
Social, legal, and ethical issues			.92								0.95

Item	Factor Loading										σ^2_c [a]
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Advance student learning in both face-to-face and virtual environments	.76										0.74
Use contemporary tools and resources to maximize content learning	.84										0.86
Exhibit knowledge and skills of an innovative professional in digital society	.83										0.88
Understand issues and responsibilities in an evolving digital culture	.79										0.85
Promote and demonstrate effective use of digital tools and resources	.83										0.89
National Educational Technology Standards	.86										0.94
Eigenvalue	20.74	3.88	3.77	2.64	2.22	2.10	1.71	1.57	1.33	1.16	
% of variance	40.67	7.61	7.40	5.18	4.36	4.12	3.36	3.09	2.61	2.27	

Note. [a]Commonality. Factor loadings less than .50 have been omitted

A subgroup of 37 of the participants, all enrolled in a basic educational technology course, were administered the BTCEI before and after instruction. Because the curriculum in this course was closely aligned to the skills contained in the BTCEI, it was hypothesized that the posttest scores would represent a significant increase over the pretest scores. Means, standard deviations, dependent *t* values, and effect sizes are presented in Table 4. A statistically significant increase in all domain and total scores is indicated, with effect sizes ranging from .62 to 1.36. While this component of the developmental study was limited by the absence of a comparison group, the outcomes suggest that the BTCEI is sensitive to improvements expected after participation in a content-specific course of instruction.

TABLE 4
Means, Standard Deviations, Dependent t Values, Confidence Intervals, and Effect Sizes

	Pretest		Posttest			95% CI		ES
Overall Subscale	M	SD	M	SD	Obtained *t*	LL	UL	
Setup, Maintenance, & Troubleshooting	2.49	0.91	3.05	0.74	-4.51*	-.82	-.31	1.36
Word Processing	3.41	0.60	3.89	0.32	-5.84*	-.66	-.32	0.62
Spreadsheet Maintenance	2.27	0.90	3.27	0.65	-7.16*	-1.28	-.72	0.96
Database Management	1.81	1.00	2.78	0.89	-6.38*	-1.28	-.66	1.35
Desktop Publishing	2.62	0.89	3.59	0.55	-7.41*	-1.24	-.71	1.06
Networking	2.84	0.90	3.65	0.48	-6.36*	-1.07	-.55	1.35
Telecommunication	3.11	0.70	3.86	0.35	-6.74*	-.99	-.53	1.12
Media Communication	2.32	0.78	3.08	0.55	-5.78*	-1.02	-.49	1.61
Social, Legal, & Ethical Issues	2.54	0.99	3.11	0.61	-3.60*	-.89	-.25	1.31
NETS	2.24	0.76	3.05	0.66	-6.36*	-1.07	-.55	0.79

Note. $*p < .05$.

Reliability

Internal consistency, as measured by Cronbach's alpha, are reported in Table 5. Cronbach's alpha coefficients ranged from .81 to .97, with Spearman-Brown corrections ranging from .90 to .98. For all items, Cronbach's alpha was .97, suggesting a high level of reliability.

TABLE 5
Number of Items and Internal Consistency Reliability Estimates for BTCEI-R

Subscale	Number of Items	Cronbach's *alpha*	Spearman-Brown Correction[1]
Setup, Maintenance, and Troubleshooting	5	0.83	0.91
Word Processing	5	0.89	0.94
Spreadsheet Maintenance	5	0.92	0.96
Database Management	5	0.96	0.98
Desktop Publishing	5	0.94	0.97
Networking	5	0.95	0.97
Telecommunication	5	0.81	0.90
Media Communication	5	0.86	0.92
Social, Legal, and Ethical Issues	5	0.97	0.98
National Educational Technology Standards	6	0.96	0.98
Total	51	0.97	

Note. [1] $r = 2r_{xx}/1+r_{xx}$

DISCUSSION

Originally "sold" as a tool to support learning, computers have also recently been promoted for benefits associated with increased productivity (Aduwa-Ogiegbaen, 2007; Charles, 2010; Efaw, 2005; Smolin & Lawless, 2007; Smolin et al., 2007; UNESCO, 2008a,b,c; U. S. Department of Education, 2004). Beyond simple computer use, technology is rapidly changing and application and use of it have created a continuing need for education professionals to be digitally literate (Calabrese, Roberts, McLeod, Niles, Christopherson, Singh, & Berry, 2008; Cuban, 2001; Leu & Kinzer, 2000; UNESCO, 2002a,b) and there is a continuing need for checking knowledge, beliefs, and attitudes of teachers and other professionals (Borthwick et al., 2004; Marcinkiewicz, 1994; Turner, 2005; Vannatta & Fordham, 2004; Wang, Ertmer, & Newby, 2004). In previous work (Flowers & Algozzine, 2000), we documented the development and technical adequacy of the *Basic Technology Competencies of Educators Inventory*. In this research, we were interested in the psychometric properties of the *Basic Technology Competencies of Educators Inventory-Revised* (BTCEI-R).

The BTCEI-R (see Appendix A) updates the original BTCEI to reflect the current competencies required for educators. Two additional domains were added to the BTCEI-R, *Desktop Publishing* and *National Education Teacher Standards*. One of the original domains, *Basic Computer Operation Skills*, was eliminated from the BTCEI-R. All the items within the domains were revised to reflect current technology terminology (e.g., elimination of the term floppy diskette).

The results of the present study provide support for the BTCEI-R as a viable measure of basic technology competencies of educators. The principal component analysis supported the theoretical structure of the 10 components. The before and after instruction study supports the predicted change that would be expected after instruction in basic technology. The internal consistency reliability coefficients indicated a high level of homogeneity within components and across all items on the BTCEI-R scores, which will result in consistent scores.

Results from the BTCEI-R can provide information to professional teacher development organizations and teacher education programs concerning training needs. The BTCEI-R can also help researchers in the area of educational technology by providing a measurable indicator of basic technology competencies for educators. The BTCEI-R should not be used for making decisions concerning individual students or teachers. Because the BTCEI-R is a self-assessment instrument, it is important that the examinee give honest responses to the items. If an examinee knows that their responses may lead to individual consequences, the examinee may not respond truthfully. However, because the BTCEI-R is a self-report instrument, preservice and career educators should be encouraged to self-evaluate and identify their own technology strengths and weaknesses and plan their professional development accordingly.

REFERENCES

Abbitt, J. T. (2011). An investigation of the relationship between self-efficacy beliefs about technology integration and Technological Pedagogical Content Knowledge (TPACK) among preservice Teachers. *Journal of Digital Learning in Teacher Education*, *27*, 134-143.

Abbitt, J., & Klett, M. (2007). Identifying influences on attitudes and self-efficacy beliefs towards technology integration among pre-service educators. *Electronic Journal for the Integration of Technology in Education, 6*, 30-42.

Aduwa-Ogiegbaen, S. E. O. (2007). Nigerian inservice teachers' self-assessment in core technology competences and their professional development needs in ICT. *Journal of Computing in Teacher Education*, *26*(1), 17-28.

Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly*, *41*, 49-82.

Archer, J. (1998). The link to higher scores. *Education Week*, *18*, 10-21.

Borthwick, A. C., Pierson, M. E., Anderson, C. L., Morris, J. L., Lathem, S. A., & Parker, H. (2004). Building learning communities to increase faculty and preservice teacher use of technology. *Journal of Computing in Teacher Education*, *21*, 23-32.

Bowes, K. A., & D'Onofrio, A. (2006). Assessing technology integration: Its validity and value for classroom practice and teacher accountability. *Australasian Journal of Educational Technology, 22*, 439-454.

Calabrese, R. L, Roberts, B. E., McLeod, S., Niles, R., Christopherson, K., Singh, P., *&* Berry, M. (2008). Emerging technologies in global communication: Using appreciative inquiry to improve the preparation of school administrators. *International Journal of Educational Management*, *22*, 696-709.

Carlson, S., & Firpo, J. (2001). Integrating computers into teaching: Findings from a 3-year program in 20 developing countries. In L. R. Vandervert, L. V. Shavinina, and R. A.Cornell (Eds.), *Cyber education: The future of long-distance learning* (85-114). Larchmont, NY: Mary Ann Liebert, Inc.

Charles, M. (2010). Whither goes the revolution? *Journal of Digital Learning in Teacher Education*, *26*(3), 82.

Cliff, N., & Pennell, R. (1967). The influence of communality, factor strength, and loading size on the sampling characteristics of factor loadings. *Psychometrika, 32*, 309–326. doi:10.1007/BF02289594

Coiro, J., Knobel, M., Lankshear, C., & Leu, D.J. (Eds). (2008). *Handbook of research on new literacies*. Mahwah, NJ: Lawrence Erlbaum.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Cambridge, MA: Harvard University Press.

Doering, A., Scharber, C., & Miller, C. (2009). GeoThentic: Designing and assessing with technology, pedagogy, and content knowledge. *Contemporary Issues in Technology and Teacher Education, 9*, 316-336.

Doherty, K. M., & Orlofsky, G. (2001). Student survey says: Schools are probably not using educational technology as wisely or effectively as they could. *Education Week*, *20*(35), 45-48.

Eaves, R. C., Raben, K., & Hall, G. (2012). The post-school outcomes transition survey: A tool for effective decision making? *Assessment for Effective Intervention*, *XX*, 1-10. doi: 10.1177/1534508412452751

Efaw, J. (2005) No teacher left behind: How to teach with technology. *Educause Quarterly*, *28*(4), 26-32. Retrieved from http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/NoTeacherLeftBehindHowtoTeachw/157372

Field, A. (2009). *Discovering statistics with SPSS*. Los Angeles: Sage.

Flowers, C. P., & Algozzine, R. F. (2000). Development and validation of scores on the Basic Technology Competencies for Educators Inventory. *Educational and Psychological Measurement, 60,* 411-418. doi: 10.1177/00131640021970628

Glass, G. V., McGaw, B., & Smith, M. L. (1981). *Meta-analysis in social research*. Beverly Hills, CA: Sage.

Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Guzman, A. A., & Nussbaum, M. M. (2009). Teaching competencies for technology integration in the classroom. *Journal of Computer Assisted Learning*, *25*, 453-469. doi: 10.1111/j.1365-2729.2009.00322.x

Hair, E., Anderson, R. E., Tatham, R. I., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Hazari, S. (1991). Microcomputer training for higher education faculty. *Educational Technology*, *31*(10), 48-50.

Hughes, J. E., McLeod, S., Dikkers, A. G., Brahier, B., & Whiteside, A. (2005). School technology leadership: Theory to practice. *Academic Exchange Quarterly*, *9*(2), 51-55.

Hutcheson, G., & Sofroniou, N. (1999). *The multivariate social scientist*. London, Sage.

IBM. (2012). IBM® SPSS® Statistics [computer software]. Somers, NY: IBM Corporation.

ISTE (International Society for Technology in Education). (2008). *NETS for Teachers (NETS•T)*. Eugene, OR: Author. Retrieved from http://www.iste.org/Libraries/PDFs/NETS-T_Standards.sflb.ashx

Kabilan, M. (2004). Online professional development: A literature analysis of teacher competency. *Journal of Computing in Teacher Education*, *21*, 51-57.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*, 31-36.

Keating, T., & Evans, E. (2001). Three computers in the back of the classroom: Pre-service teachers' conceptions of technology integration. In J. Price, D. A. Willis, N. Davis, & J. Willis (Eds.), *Proceedings of the Society for Information Technology & Teacher Education International Conference 2001*, (pp. 1671–1676). Chesapeake, VA: AACE.

Lawless, K., & Pellegrino J. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research 77*, 575-614.

Leu, D. J., Jr., & Kinzer, C. K. (2000). The convergence of literacy instruction with networked technologies for information and communication. *Reading Research Quarterly*, *35*, 108-127.

Li Q. (2007) Student and teacher views about technology: a tale of two cities? *Journal of Research on Technology in Education 39*, 377-397.

Marcinkiewicz, H. (1994). Computers and teachers: Factors influencing computer use in the classroom. *Journal of Research on Computing in Education, 26*, 220-236.

Martin, F., & Dunsworth, Q. (2007). A methodical formative evaluation of computer literacy course: What and how to teach. *Journal of Information Technology Education*, *6*, 123-134.

Ministerial Advisory Council on the Quality of Teaching. (1998). *Towards greater professionalism: Teacher educators, teaching and the curriculum report*. Sydney, NSW: Department of Education and Training Ministerial Advisory Council on the Quality of Teaching.

Morris, S. B., & DeShon, R. P. (2002). Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods*, *7*, 105-125.

Pennell, R. (1968). The influence of communality and N on the sampling distributions of factor loadings. *Psychometrika, 33*, 423–439. doi:10.1007/BF02290161

Pishghadam, R., Noghani, M., & Zabihi, R. (2011). The construct validation of a questionnaire of social and cultural capital. *English Language Teaching*, *4*(4), 195-203. doi:10.5539/elt.v4n4p195

Smolin, L., & Lawless, K. (2007). Technologies in schools: Stimulating a dialogue. In L. Smolin, K., Lawless, K., C. Dede, S. Jones, C., Johnson-Yale, F. Perez, ... N. C. Burbules, *Yearbook of the National Society for the Study of Education* (pp. 1-10). Malden, MA: Blackwell Publishing.

Smolin, L., Lawless, K., Dede, C., Jones, S., Johnson-Yale, C., Perez, F., & ... Burbules, N. C. (2007). *Yearbook of the National Society for the Study of Education*, *106*(2), 1-218. Malden, MA: Blackwell Publishing.

Sprague, D., Kopman, K., & Dorsey, S. (1988). Faculty development in the integration of technology in teacher education courses. *Journal of Computing in Teacher Education*, *2*(14), 24-28.

Stobaugh, R., & Tassell, J. (2011). Analyzing the degree of technology use occurring in pre-service teacher education. *Educational Assessment, Evaluation and Accountability*, *23*, 143-157.

Stuhlman, J. (1998). A model for infusing technology into teacher training programs. *Journal of Technology and Teacher Education*, *6*, 125-139.

Tabachnick, B. G., & Fidell, L.S. (2001). *Using multivariate statistics* (4th ed.). New York: Harper & Row.

Tapscott, D. (1999). Educating the net generation. *Educational leadership, 56*(5), 7-19.

Topper, A. (2004). How are we doing? Using self-assessment to measure changing teacher technology literacy within a graduate educational technology program. *Journal of Technology & Teacher Education*, *12*(3), 303-317. Also retrieved from http://www.thefreelibrary.com/How+are+we+doing%3f+Using+self-assessment+to+measure+changing+teacher...-a0123128004

Turner, L. (2005). 20 technology skills every educator should have. Retrieved from http://thejournal.com/articles/2005/06/01/20-technology-skills-every-educator-should-have.aspx

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2002a). *Information and communication technology in education; A curriculum for schools and programmes of teacher development*. Paris: UNESCO. Retrieved from http://unesdoc.unesco.org/images/0012/001295/129538e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2002b). *Information and communication technologies in teacher education: A planning guide*. Paris: UNESCO. Retrieved from http://unesdoc.unesco.org/images/0012/001295/129533e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2008a). *ICT competency standards for teachers: Competency standards modules.* Paris: UNESCO. Retrieved from http://cst.unesco-ci.org/sites/projects/cst/The%20Standards/ICT-CST-Competency%20Standards%20Modules.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2008b). *ICT competency standards for teachers: Implementation guidelines.* Paris: UNESCO. Retrieved from http://cst.unesco-ci.org/sites/projects/cst/The%20Standards/ICT-CST-Implementation%20Guidelines.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2008c). *ICT competency standards for teachers: Policy framework.* Paris: UNESCO. Retrieved from http://cst.unesco-ci.org/sites/projects/cst/The%20Standards/ICT-CST-Policy%20Framework.pdf

U. S. Department of Education. (2004). *84.318—Technology literacy challenge fund grants*. Retrieved from http://www.ed.gov/about/reports/annual/2004plan/edlite-enhancing.html

U. S. Department of Education. (2008). *National educational technology trends study: Local-level data summary*. U.S. Department of Education, Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service: Washington, D.C. Retrieved from http://www.eric.ed.gov/PDFS/ED504192.pdf

Vannatta, R. A., & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education, 36*, 253-271.

Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing preservice teachers' self-efficacy beliefs for technology integration. *Journal of Research on Technology in Education, 36*, 231-250.

Willis, J. (2006). Creating a working model for technology integration through a lesson planning webquest. *Electronic Journal for the Integration of Technology in Education*, *5*, 25-33. Retrieved from http://ejite.isu.edu/Volume5/Willis.pdf

APPENDIX A.

Basic Technology Competencies for Educators Inventory-Revised

For each item below, please circle the response that best describes your technology skills and abilities based on the following scale: A = Not Very Competent (cannot consistently perform the task independently); B = Somewhat Competent (can perform task with assistance); C = Competent (can consistently complete the task independently); and, D = Very Competent (can teach others how to perform the task)

	Not Very Competent	Somewhat Competent	Competent	Very Competent
Setup, Maintenance, and Troubleshooting of Equipment				
1. Backup files (CD, flash drive, hard drive, other media)	A	B	C	D
2. Use virus protection software	A	B	C	D
3. Connect peripheral devices (printer, camera, scanner)	A	B	C	D
4. Run defragmenter or other system tools on hard drive	A	B	C	D
5. Overall rating of setup, maintain, and troubleshoot equipment	**A**	**B**	**C**	**D**
Word Processing				
6. Set margins and insert header, footer, and/or page numbers in documents	A	B	C	D
7. Change font size, type, and style	A	B	C	D
8. Cut, copy, and paste within and between documents	A	B	C	D
9. Insert files, graphics, and tables in documents	A	B	C	D
10. Overall rating of word processing	**A**	**B**	**C**	**D**
Spreadsheet Management				
11. Enter data in cells	A	B	C	D
12. Move data within and between spreadsheets	A	B	C	D
13. Use formulas	A	B	C	D

	Not Very Competent	Somewhat Competent	Competent	Very Competent
14. Create charts	A	B	C	D
15. Overall rating of spreadsheet management	**A**	**B**	**C**	**D**
Database Management				
16. Enter data in a database	A	B	C	D
17. Sort, filter, and search in a database	A	B	C	D
18. Produce a *report* and/or run a *query* in a database	A	B	C	D
19. Merge database information into word processing document	A	B	C	D
20. Overall rating of database management	**A**	**B**	**C**	**D**
Desktop Publishing				
21. Find and use templates	A	B	C	D
22. Change text, margins, tabs, spacing, and other formatting options	A	B	C	D
23. Insert clipart, text, graphics, and other images	A	B	C	D
24. Create and distribute electronic newsletters	A	B	C	D
25. Overall rating of desktop publishing	**A**	**B**	**C**	**D**
Networking				
26. Log on a network	A	B	C	D
27. Work in a network environment	A	B	C	D
28. Share files electronically via the network	A	B	C	D
29. Use blogs and/or wikis or other social/professional networks	A	B	C	D
30. Overall rating of networking	**A**	**B**	**C**	**D**

	Not Very Competent	Somewhat Competent	Competent	Very Competent
Telecommunication				
31. Send and receive E-mail and attachments	A	B	C	D
32. Locate research and teaching resources using the Internet	A	B	C	D
33. Use of instant and/or text messaging	A	B	C	D
34. Use of videoconferencing software (Skype, Adobe Connect, WebEx, etc;)	A	B	C	D
35. Overall rating of telecommunication	**A**	**B**	**C**	**D**
Media Communication				
36. Use a document camera (image presenter, digital overhead, docucam)	A	B	C	D
37. Develop an interactive electronic slide show	A	B	C	D
38. Develop a presentation including text, graphics, and sounds	A	B	C	D
39. Develop a podcast	A	B	C	D
40. Overall rating of media communication	**A**	**B**	**C**	**D**
Social, Legal, and Ethical Issues				
41. Share knowledge and abide by copyright laws and fair use guidelines	A	B	C	D
42. Share knowledge and abide by shareware regulations	A	B	C	D
43. Share knowledge and abide by intellectual property rights	A	B	C	D
44. Share knowledge about software piracy	A	B	C	D
45. Overall rating of social, legal, and ethical issues	**A**	**B**	**C**	**D**
National Educational Technology Standards				
46. Advance student learning in both face-to-face and virtual environments	A	B	C	D

	Not Very Competent	Somewhat Competent	Competent	Very Competent
47. Use contemporary tools and resources to maximize content learning	A	B	C	D
48. Exhibit knowledge and skills of an innovative professional in digital society	A	B	C	D
49. Understand issues and responsibilities in an evolving digital culture	A	B	C	D
50. Promote and demonstrate effective use of digital tools and resources	A	B	C	D
51. Overall rating of National Educational Technology Standards	**A**	**B**	**C**	**D**

General Information

For each item below, please circle appropriate response or fill in the blank. Thank you!

52. Gender: Male Female

53. Marital Status: Single Married Separated/Divorced

54. Ethnicity: African American White Hispanic Other

55. Number of years as a schoolteacher: _______________

56. Number of years as a school administrator: _____________

57. Current position: Undergraduate Student Graduate Student
School District Central Office Superintendent Asst/Assoc Superintendent
Principal Assistant Principal Teacher Other: _______________