



**Instruments
for
Assessing
Educator Progress
in
Technology Integration**

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Introduction

Information technology in education can be studied at many levels. Categories of analysis made common by the International Association for the Evaluation of Educational Achievement (IEA) and now used in many nations include the:

- macro level - educational system policy making level
- meso level - campus or local unit level, and
- micro level - classroom level (Pelgrum & Anderson, 1999).

Consideration for technology integration must take place at all levels. The macro and meso level have a facilitating role in integrating technology at the classroom level.

Most definitions of technology integration assume that the mode of student learning with technology is at a higher cognitive level than the conveyance of facts and theories (Plomp, 1996). According to Dockstader (1999, p. 73-74), technology integration includes:

- using computers effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in meaningful ways,
- incorporating technology in a manner that enhances student learning, and
- organizing the goals of curriculum and technology into a coordinated, harmonious whole.

This perspective on technology integration also implies a change in teaching behaviors. Teachers are confronted with teaching and learning environments that are very different from the ones they experienced when they were educated themselves and with which they feel familiar.

Technology integration promotes a shift in teaching paradigms from whole class instruction to small group learning environments as well as a change from passive learning to more engaged learning (Pelgrum & Anderson, 1999; Roblyer & Edwards, 2000; Voogt & Odenthal, 1999).

At all three levels discussed above, there is a need to assess the progress teachers make in technology integration in the classroom. Assessment of educator progress in technology integration requires: a) gathering information about the quality and quantity of information technology used for student learning in a classroom, and b) making a judgment regarding the extent of integration taking place.

ASSESSMENT OPTIONS

Options for assessing technology integration generally fall into three categories of research methods (Poirot & Knezek, 1992):

- Qualitative Methods - triangulation of findings based on multiple observations
- Quantitative Methods - gathering numbers (measuring) through some objective means and applying statistical analyses to reduce the data to findings, and
- Mixed Methods - combinations of qualitative and quantitative methods.

Many evaluators find that quantitative methods are useful for measuring what is taking place in a classroom environment in an unbiased manner, while qualitative methods are invaluable for explaining why.

TYPES OF INSTRUMENTS

Researchers typically use some form of structured guide or instrument to gather information about technology integration by teachers, regardless of whether qualitative or quantitative methods are being employed. These instruments can be grouped into at least seven major categories, according to the type of information they are used to gather:

- **Attitudes** - feelings or perceptions
- **Needs** - desires or perceived priorities
- **Beliefs** - long lasting items of faith,
- **Knowledge** - mastery of facts and theories,
- **Skills** - ability to perform tasks,
- **Behaviors** - performance of tasks, and
- **Levels of Proficiency** - designations or classifications of teachers' use of technology.

Literally hundreds of forms, scales and instruments have been developed to gather information in these and other areas. Those presented in this book are intended primarily for quantitative methods.

EXAMPLES OF INSTRUMENTS

Attitude Instruments

Teachers' Attitudes Toward Computers (TAC) (Christensen & Knezek, 1998) is a 95-199-item Likert/Semantic Differential Instrument for measuring teachers' attitudes toward computers on 7- 20 constructs.

Teachers' Attitudes Toward Information Technology (TAT) (Knezek & Christensen, 1998) complements Teachers' Attitudes Toward Computers Questionnaire to provide assessment in New Information Technologies (electronic mail, multimedia, the World Wide Web, teacher productivity, and classroom productivity for students). It is constructed primarily from semantic differential items.

Skill/Competency

Technology Proficiency Self-Assessment (Ropp, 1999) measures educator proficiency in electronic mail, the World Wide Web, Integrated Applications and Teaching with Technology.

Technology in Education Competency Survey (Christensen, 1999) is a self-assessment rating form covering teacher competencies in nine major areas addressed by the National Council for the Accreditation of Teacher Education (NCATE) standards for the USA.

Level of Proficiency

Stages of Adoption (Christensen, 1997) is a self-assessment instrument of a teacher's level of adoption of technology.

Level Of Use (Griffin & Christensen, 1999) is a self-assessment instrument adapted from the Concerns-Based Adoption Model (CBAM) Level of Use designations for adoption of an educational innovation

Theoretical Classifications

Two theoretical approaches that form a logical basis for selecting assessment instruments at the micro level of technology integration are presented in this book. The first theory is Diffusion of Innovation. Early research by Rogers (1983) has found that adoption of new innovations is an active process that involves much reinvention. Adopters must reinvent the innovation and make it their own if they are to continue using it. The *Concerns-Based Adoption Model* (CBAM) was developed by Hall and Rutherford in the early 1970s for the study of adoption of any new educational innovation (Hall & Rutherford, 1974). CBAM Stages of Concern (1974) and Level of Use (Hall, Loucks, Rutherford, & Newlove, 1975) classifications have been adapted for information technology innovations and used by researchers on several continents over the past three decades. The Level of Use form, which is included in this book is based on CBAM work.

The second approach is a *Structural Model of Technology Integration* developed by Knezek and Christensen (Knezek, Christensen, Hancock, & Shoho, 2000). This model is based on the assumption that the educator's will (positive attitudes), skill (competency, ability to perform tasks), and access to technology tools, are all required for successful technology integration. The model is grounded in educational psychology principles which determine key variables influencing the school learning environment (Klausmeir & Goodwin, 1975), and it relies on the multivariate technique of *Structured Equation Modeling* (Schumacker, 1996) to guide measurement techniques. The instruments presented in this book are generally organized along these lines.

Instruments

This booklet is for educators who wish to measure attitudes toward information technology for one or more of the following groups:

- K-12 students
- K-12 pre-service/in-service teachers
- University faculty

Nine instruments are provided for this purpose:

- The Young Children's Computer Inventory (YCCI)
- The Computer Attitude Questionnaire (CAQ)
- The Teachers' Attitudes Toward Computers (TAC)
- The Teachers' Attitudes Toward Information Technology (TAT)
- The Faculty Attitudes Toward Information Technology (FAIT)
- Stages of Adoption of Technology,
- Concerns-based Adoption Model-Levels of Use (CBAM-LoU)
- Technology Proficiency Self-Assessment (TPSA)
- Technology in Education Competency Survey (TECS)

The instruments are intended to complement each other so that a profile of educators' attitudes and learner dispositions for an entire school system can be obtained, if desired. For example, the YCCI, CAQ, and TAC each contain two computer attitude subscales that measure the same constructs in primary school children, middle school students, and teachers.

Various sections of the instruments employ Likert ('strongly disagree' to 'strongly agree') items, Semantic Differential items (ratings along a continuum between opposite pairs), and paired comparisons items (forced choice between two alternatives). Most operate on the principle that several items, when summed together, produce a more reliable index than a single item alone, and all are constructed so that each subscale can be used independently of the others.

These instruments have been developed and validated over the past ten years by researchers associated with the Institute for the Integration of Technology into Teaching and Learning (IITTL). All have built upon the work of previous scholars in many states and nations with support from numerous agencies, including the Meadows Foundation, the Japan Society for the Promotion of Science, the Fulbright Foundation, and the Texas Center for Educational Technology. Four of the nine instruments were developed in conjunction with doctoral dissertations, while a fifth was a product of a two-year research initiative funded by the Matthews Chair for Research in Education at the University of North Texas. All have been validated in numerous state, national, and international studies, and two of the development efforts were recognized by awards from the American Educational Research Association (Knezek & Miyashita, 1991) and the Society for Information Technology in Teacher Education (Christensen & Knezek, 1997).

Internal Consistency Reliability

Reliability refers to the ability of a questionnaire to measure accurately. Internal consistency reliability (Marshall & Hales, 1972) is determined by checking the components of a questionnaire against each other. Internal consistency reliability in the form of Cronbach's Alpha is the type reported in this book.

Internal consistency reliabilities vary from a low of 0 to a high of 1.0 and represent the proportion of the variance in the respondents' scores that are attributable to true differences on the psychological construct (DeVellis, 1991). The guidelines shown in Table 1 have been proposed by DeVellis regarding acceptable reliabilities for research instrument scales:

Below .60	Unacceptable
Between .60 and .65	Undesirable
Between .65 and .70	Minimally acceptable
Between .70 and .80	Respectable
Between .80 and .90	Very good
Much above .90	Consider shortening the scale

(DeVellis, 1991, p.85).

Young Children's Computer Inventory

INTRODUCTION

The Young Children's Computer Inventory (YCCI v5.27) is a 51-item, 4 point Likert instrument for measuring primary and intermediate (1st through 6th grade) school children's attitudes on seven major subscales. The YCCI is designed to measure attitudes (feelings toward a person or thing) and prevailing attitudes (dispositions), rather than achievement. The seven major indices are:

- **Computer Importance** - perceived value or significance of knowing how to use computers,
- **Computer Enjoyment** - amount of pleasure derived from using computers,
- **Study Habits** - mode of pursuing academic exercises within and outside class, **Empathy** - a caring identification with the thoughts or feelings of others, **Motivation** - unceasing effort; perseverance; never giving up,
- **Creative Tendencies** - inclinations toward exploring the unknown, taking individual initiative, finding unique solutions, and
- **Attitudes Towards School** - perceived value or significance of school.

Eighteen paired comparisons items also assess children's relative preferences for using a computer versus reading a book, writing a story, and watching television. Relative difficulty and utility for learning are assessed as well.

RECOMMENDED ADMINISTRATION PROCEDURES

The YCCI has been successfully used for group administration to classes in school, as well as for home administration under the supervision of a parent or guardian. Appropriate instructions are included on the two versions of the form:

School use: This questionnaire has 4 parts. Follow along with each statement as your teacher reads it and then circle the number which best shows how you feel.

Home use: This questionnaire has 4 parts. Read and discuss each of the following statements with your child and mark the response your child gives you.

Classroom administration takes 30-40 minutes for a typical primary school class, while home administration is usually faster. A longer time is required in class because the teacher must wait until the slowest student finishes each question before having the group proceed to the next item. Home administration provides a slightly more reliable response, but it also allows the possibility of parental bias entering into the student's response. Teachers and parents are encouraged to provide explanations of items to the children as needed, but to let the child decide for himself/herself regarding the extent of agreement or disagreement.

First grade teachers have reported success in having students cover their questionnaires with a slotted piece of paper that slides down the page to expose one item at a time. Most students appear to have little difficulty circling a number to indicate how strongly they agree or disagree with an item, once they understand the statement's meaning.

YCCI INTERNAL CONSISTENCY RELIABILITY

Internal consistency reliability estimates for YCCI subscales based on 1992 grade 1-3 data from the USA, Japan, and Mexico are listed in Table 2. These fall in the range "minimally acceptable" to "very good" according to the guidelines provided by Devellis (1991).

Subscale	Alpha	No. of Items
Creative Tendencies	.85	13
Computer Enjoyment	.72	5
Computer Importance	.77	9
Empathy	.77	9
Study Habits	.80	7
Motivation/Persistence	.66	6

Internal consistency reliabilities for the paired comparisons portions of the YCCI are thought to be quite high. A circular triad analysis of 1993 paired comparisons data (n=210) at the University of Hawaii indicated reliabilities of .90 for Computer Preference, .89 for Computer Difficulty, and .92 for Computer Learning (Dunn-Rankin, 1983; Knezek & Miyashita, 1994). Since data from students in grades 4-8 was included in the 1993 analysis, it is probable that the numbers are appropriate for both elementary and middle school students.

STUDIES AND REPORTS USING YCCI

Knezek, G. A., Miyashita, K.T., Lai, M., Sakamoto, T., Southworth, J., & Sakamoto, A. (1994). *Studies on Children and Computers: The 1993-1994 Fulbright Series*. Denton, TX: Texas Center for Educational Technology.

SCORING THE YCCI (v5.27)

The Young Children's Computer Inventory (YCCI v5.27) contains 51, Likert-type self-report items. Students record their own perceptions of the extent to which they agree or disagree with each item, under the supervision of a teacher in the classroom environment, or a parent in the home. Up to seven separate indices can be produced by averaging responses to related items. These indices include two kinds of attitudes toward computers: Computer Importance and Computer Enjoyment; two kinds of attributes related to motivation to study: Study Habits and Motivation/Persistence; Empathy; Creative Tendencies, and Attitudes Toward School. Items for the subscales related to attitudes toward computers and motivation to study can be combined in each category to form more reliable scales. The following sections describe how to score each measurement scale.

Likert Items

The seven subscales are Computer Importance (I); Computer Enjoyment (J); Study Habits (S); Empathy (E); Motivation/Persistence (M); Creative Tendencies (C); and Attitudes Toward School (SC). The items of the subscales are distributed among the first four parts of the YCCI (v5.27) and are shown in Table 3.

Subscale	Part	Question Numbers
Computer Importance (I)	1	3, 6, 7, 8, 10, 11
Computer Enjoyment (J)	1	1, 2*, 4, 5, 9
Motivation/Persistence (M)	2	2, 3, 7, 8, 9
Study Habits (S)	2	1, 4, 5, 6, 10, 11
Empathy (E)	3	1, 2, 3, 4, 5, 6, 7, 8, 9
Attitudes Toward School (SC)	3	10, 11*, 12, 13*
Creative Tendencies (C)	4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

* negative wording, reverse these 3 items before summing

The recommended YCCI scoring procedure for the first four parts is to simply average the numeric value of the responses for the related items to produce seven subscales scores. However, three items on the YCCI have negative wording and must be reversed before adding to the others. These items are: item 2 on Part 1 and items 11 and 13 on Part 3. If the student selected 1 or No, change it to 4 or Yes. If a student selected 3 or Maybe Yes, change it to 2 or Maybe No. For example, Computer Enjoyment will be the sum of five items (1, 2, 4, 5, and 9) in Part 1, with item 2 reversed before inclusion in the sum. To generate an average for each subscale, take the sum of the items and divide by the number of items.

If the researcher is using a statistical package, such as SPSS, this guide to the variable numbering used in the "SPSS command application" shown below will be helpful. Even though the items for the seven subscales are distributed throughout the first four parts of the YCCI (v5.27), the variables are numbered sequentially for data entry purposes. For example, the items in Part 1 are numbered 1 through 11, and also variable (var) 1 through 11. The items in Part 2 are also numbered 1 through 11; however, the variables (var) are 12 through 22. The variables for each subscale are shown in Table 4.

Table 4. Subscale to Variable Conversions.

Subscale	Part	Variable Number
Computer Importance (I)	1	variables 3, 6, 7, 8, 10, 11
Computer Enjoyment (J)	1	variables 1, 2, 4, 5, 9
Motivation/Persistence (M)	2	variables 13, 14, 18, 19, 20
Study Habits (S)	2	variables 12, 15, 16, 17, 21, 22
Empathy (E)	3	variables 23 through 31
Attitudes Toward School (SC)	3	variables 32, 33, 34, 35.
Creative Tendencies (C)	4	variables 36 through 48

Step-by-Step Scoring Procedures:

1. Reverse the negatively worded items within each subscale.

- Three items in the YCCI (v5.2x) subscales have negative wording. These items are Part 1- item 2, and Part 3 - items 11 and 13 (variables 2, 33, and 35).
- To ensure that this alternate positioning does not invalidate summed scores, the scoring process must include reversal (reflection) of items negatively worded.
- An SPSS command example:

```
compute varx = 5 - varx.
```

(where x is the variable that represents the item in the scale and where 5 is used for any 4-position scale)

- SPSS command application:

```
compute var2 = 5 - var2.
```

```
compute var33 = 5 - var33.
```

```
compute var35 = 5 - var35.
```

```
missing values var2 var33 var35(5).
```

2. Generate an average score for each subscale.

- For each subscale, add all responses and divide by the number of items.
- An SPSS command example:

compute J = (var1+var2+var3+...+varn)/n.

- SPSS command application:

compute I = (var3+var6+var7+var8+var10+var11)/6.

compute J = (var1+var2+var4+var5+var9)/5.

compute M = (var13+var14+var18+var19+var20)/5.

compute S = (var12+var15+var16+var17+var21+var22)/6.

compute E = (var23+var24+var25+var26+var27+var28+var29+var30+var31)/9.

compute SC = (var32+var33+var34+var35)/4.

compute C =

(var36+var37+var38+var39+var40+var41+var42+var43+var44+var45+var46+var47+var48)/13.

Paired Comparisons Items

This portion of the instrument has three sub-sections to measure "preference for", "difficulty of" and "learn most from" 6 activity paired comparisons. The respondent chooses between the two activities. Step-by-step procedures for scoring this scale are:

Scoring Procedures:

1. Generate an SPSS command.

- SPSS command application:

compute PREAD = 0.

IF (var49 EQ 1) PREAD = sum(PREAD,1). IF

(var52 EQ 2) PREAD = sum(PREAD,1). IF

(var53 EQ 1) PREAD = sum(PREAD, 1).

compute PWRITE = 0.

IF (var49 EQ 2) PWRITE = sum(PWRITE,1). IF

(var50 EQ 1) PWRITE = sum(PWRITE,1). IF

(var54 EQ 1) PWRITE = sum(PWRITE,1).

compute PTV = 0.

IF (var50 EQ 2) PTV = sum(PTV,1).

```

IF (var51 EQ 1) PTV = sum(PTV,1). IF
(var53 EQ 2) PTV = sum(PTV,1).
compute PCOMP = 0.
IF (var51 EQ 2) PCOMP = sum(PCOMP,1). IF
(var52 EQ 1) PCOMP = sum(PCOMP,1). IF
(var54 EQ 2) PCOMP = sum(PCOMP,1).
compute DREAD = 0.
IF (var55 EQ 1) DREAD = sum(DREAD,1). IF
(var58 EQ 2) DREAD = sum(DREAD,1). IF
(var59 EQ 1) DREAD = sum(DREAD,1).
compute DWRITE = 0.
IF (var55 EQ 2) DWRITE = sum(DWRITE,1). IF
(var56 EQ 1) DWRITE = sum(DWRITE,1). IF
(var60 EQ 1) DWRITE = sum(DWRITE,1).
compute DTV = 0.
IF (var56 EQ 2) DTV = sum(DTV,1). IF
(var57 EQ 1) DTV = sum(DTV,1). IF
(var59 EQ 2) DTV = sum(DTV,1).
compute DCOMP = 0.
IF (var57 EQ 2) DCOMP = sum(DCOMP,1). IF
(var58 EQ 1) DCOMP = sum(DCOMP,1). IF
(var60 EQ 2) DCOMP = sum(DCOMP,1).
compute LREAD = 0.
IF (var61 EQ 1) LREAD = sum(LREAD,1). IF
(var64 EQ 2) LREAD = sum(LREAD,1). IF
(var65 EQ 1) LREAD = sum(LREAD,1).
compute LWRITE = 0.
IF (var61 EQ 2) LWRITE =sum(LWRITE,1). IF
(var62 EQ 1) LWRITE =sum(LWRITE,1). IF
(var66 EQ 1) LWRITE =sum(LWRITE,1).
compute LTV = 0.
IF (var62 EQ 2) LTV = sum(LTV,1). IF
(var63 EQ 1) LTV = sum(LTV,1). IF
(var65 EQ 2) LTV = sum(LTV,1).
compute LCOMP = 0.
IF (var63 EQ 2) LCOMP = sum(LCOMP,1). IF
(var64 EQ 1) LCOMP = sum(LCOMP,1). IF
(var66 EQ 2) LCOMP = sum(LCOMP,1).

```

Please note: The suggested variable number (to be used with statistical packages) is listed after each statement in the survey. These are used in the SPSS command example shown above.

Computer Attitude Questionnaire

INTRODUCTION

The Computer Attitude Questionnaire (CAQ v5.27) contains a 95-item, 5-point Likert-type self-report questionnaire to be used with students in middle school and high school (seventh through twelfth grades). The CAQ is designed to measure attitudes (feelings toward a person or thing) and prevailing attitudes (dispositions), rather than achievement. Students record their own perceptions of the extent to which they agree or disagree with each item. The CAQ includes the seven YCCI separate indices (Computer Importance; Computer Enjoyment; Study Habits; Empathy; Motivation/Persistence; Creative Tendencies and School) plus scales for Computer Anxiety and Self-Concept, a General Computer Skill Level assessment and a modified Technology Proficiency Self-Assessment. The CAQ also includes the three paired-comparison sets from the YCCI (v5.27).

RECOMMENDED ADMINISTRATION PROCEDURES

Classroom administration takes 20-25 minutes for a typical middle school class. Experience to date indicates that students have no difficulty completing the questionnaire without teacher assistance. Classroom administration for high school is usually 15-20 minutes.

CAQ INTERNAL CONSISTENCY RELIABILITY

Internal consistency reliability estimates for the CAQ are based on grades 7-12 data from Texas students in a large metropolitan school district during 2000, are listed in Table 5. These range from respectable to very good according to the guidelines provided by DeVellis (1991).

Table 5. Internal Consistency Reliability for CAQ

Subscales	Alpha	No. of Variables	N Cases
Computer Anxiety (A)(lack of)	.89	8	1302
Creativity (C)	.87	13	1087
Empathy (E)	.88	10	1319
Computer Importance (I)	.80	6	1322
Computer Enjoyment (J)	.84	9	1309
Motivation/Persistence (M)	.77	9	1303
Study Habits (S)	.81	10	1306
Attitudes Toward School (SC)	.72	6	1126

Table 5. Internal Consistency Reliability for CAQ cont.

Subscales	Alpha	No. of Variables	N Cases
Self-Concept	.88	10	1084
General Skill Level	.77	7	1110
TPSA - Electronic Mail	.84	3	1130
TPSA - World Wide Web	.78	4	1118
TPSA - IA	.75	3	1124
TPSA - All	.91	11	1083

Note: Reliability estimates are based on data gathered online from 7-12 students in a large metropolitan school district in Texas during April - May 2000.

Internal consistency reliabilities for the paired comparisons portions of the YCCI and CAQ are thought to be quite high. A circular triad analysis of 1993 paired comparisons data (n=210) at the University of Hawaii indicated reliabilities of .90 for Computer Preference, .89 for Computer Difficulty, and .92 for Computer Learning (Dunn-Rankin, 1983; Knezek & Miyashita, 1994).

Since data from students in grades 4-8 was included in the 1993 analysis, it is probable that the numbers are appropriate for both elementary and middle school students.

STUDIES USING CAQ

Knezek, G., & Christensen, R. (1997). *Attitudes Toward Information Technology at Two Parochial Schools in North Texas*. Denton, TX: Texas Center for Educational Technology.

Knezek, G., & Christensen, R. (1995). *A Comparison of Two Computer Curricular Programs at a Texas Junior High School Using the Computer Attitude Questionnaire (CAQ)*. Denton, TX: Texas Center for Educational Technology.

SCORING THE CAQ (v5.27)

The Computer Attitude Questionnaire (CAQ v5.27) contains 95, 5-point Likert-type self-report items for measuring middle school and high school students' attitudes on all Young Children's Computer Inventory subscales plus Computer Anxiety and Self-Concept. The CAQ (v5.27) includes the seven YCCI separate indices (Computer Importance; Computer Enjoyment; Study Habits; Empathy; Motivation/Persistence; Creative Tendencies and Attitudes Toward School) plus subscales for Computer Anxiety and Self-Concept, a General Computer Skill Level assessment and a modified Technology Proficiency Self-Assessment. The paired-comparisons portion of the Young Children's Computer Inventory is also included on the instrument. The following sections describe how to score each subscale.

Likert Items

The items of the subscales are distributed among the parts of the CAQ (v5.27)

Table 6. Subscale to Item Number Conversions.

Subscale	Part	Item Numbers
Computer Importance (I)	1	3, 6, 7, 8, 10, 11
Computer Enjoyment (J)	1	1, 2*, 4, 5, 9, 12, 13, 15, 18
Study Habits (S)	2	21, 24, 25, 26, 29, 30, 31, 32, 33, 34,
Motivation/Persistence (M)	2	21, 22, 23, 25, 27, 28, 29, 34
Empathy (E)	3	36, 37, 38, 39, 40, 41, 42, 43, 44, 45
Creative Tendencies (C)	4	46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58
Attitudes Toward School (SC)	6	62, 63, 64, 65, 66, 67
Computer Anxiety	1	12, 13, 14, 15, 16, 17, 18, 19
Self-Concept	7	68, 69, 70, 71, 72, 73, 74, 75, 76, 77

The recommended CAQ scoring procedure is to simply average the numeric values of the responses for the related items to produce nine subscales scores.

However, thirteen items on the CAQ have negative wording and must be reversed before adding to the others. These items are numbered 2, 13, 14, 15, 16, 17, 18, 20, 63, 65, 69, 70, 74, and 75. If the student selected 1 or SD (Strongly Disagree), change it to 5 or SA (Strongly Agree); if a student selected 4 or A (Agree), change it to 2 or D (Disagree). For example, Computer Enjoyment will be produced from the nine items (1, 2, 4, 5, 9, 12, 13, 15, and 18), with items 2, 13, 15, and 18 reversed before inclusion in the sum. To generate an average for each subscale, take the sum of the items and divide by the number of items.

Step-by-Step Scoring Procedures:

1. Reverse the items negatively worded within each subscale.

- Thirteen items in the CAQ (v5.2x) subscales have negative wording. These items are (2), (13), (14), (15), (16), (17), (18), (63), (65), (69), (70), (74), and (75).
- To ensure that this alternate positioning does not invalidate summed scores, the scoring process must include reversal (reflection) of items negatively worded.
- An SPSS command example

compute varx = 6 - varx.

(where x is the variable that represents the item in the scale and where 6 is used for any 5-position scale)

1. Generate an average score for each subscale.

For each subscale, add all responses and divide by the number of items. An SPSS command example:

```
compute J = (var1+var2+ var4+ ... +varn)/n.
```

Paired Comparisons Scoring

This portion of the instrument has three sub-sections to measure "preference for", "difficulty of" and "learn most from" of 6 activity paired comparisons. The respondent chooses between the two activities. Step-by-step procedures for scoring this scale are:

Scoring Procedures:

1. Generate an SPSS command.

- SPSS command application:

```
compute PREAD = 0.  
IF (var23 EQ 1) PREAD = sum(PREAD,1). IF  
(var26 EQ 2) PREAD = sum(PREAD, 1). IF  
(var27 EQ 1) PREAD = sum(PREAD, 1).  
compute PWRITE = 0.  
IF (var23 EQ 2) PWRITE = sum(PWRITE,1). IF  
(var24 EQ 1) PWRITE = sum(PWRITE,1). IF  
(var28 EQ 1) PWRITE = sum(PWRITE,1).  
compute PTV = 0.  
IF (var24 EQ 2) PTV = sum(PTV,1). IF  
(var25 EQ 1) PTV = sum(PTV,1). IF  
(var27 EQ 2) PTV = sum(PTV,1).  
compute PCOMP = 0.  
IF (var25 EQ 2) PCOMP = sum(PCOMP,1). IF  
(var26 EQ 1) PCOMP = sum(PCOMP,1). IF  
(var28 EQ 2) PCOMP = sum(PCOMP,1).  
compute DREAD = 0.  
IF (var29 EQ 1) DREAD = sum(DREAD,1). IF
```

(var32 EQ 2) DREAD = sum(DREAD,1).

IF (var33 EQ 1) DREAD = sum(DREAD,1).

compute DWRITE = 0.

IF (var29 EQ 2) DWRITE = sum(DWRITE,1). IF

(var30 EQ 1) DWRITE = sum(DWRITE,1). IF

(var34 EQ 1) DWRITE = sum(DWRITE,1).

compute DTV = 0.

IF (var30 EQ 2) DTV = sum(DTV,1).

IF (var31 EQ 1) DTV = sum(DTV,1).

IF (var33 EQ 2) DTV = sum(DTV,1).

compute DCOMP = 0.

IF (var31 EQ 2) DCOMP = sum(DCOMP,1).

IF (var32 EQ 1) DCOMP = sum(DCOMP,1).

IF (var34 EQ 2) DCOMP = sum(DCOMP,1).

compute LREAD = 0.

IF (var35 EQ 1) LREAD = sum(LREAD,1). IF

(var38 EQ 2) LREAD = sum(LREAD,1). IF

(var39 EQ 1) LREAD = sum(LREAD,1).

compute LWRITE = 0.

IF (var35 EQ 2) LWRITE =sum(LWRITE,1). IF

(var36 EQ 1) LWRITE =sum(LWRITE,1). IF

(var40 EQ 1) LWRITE =sum(LWRITE,1).

compute LTV = 0.

IF (var36 EQ 2) LTV = sum(LTV,1). IF

(var37 EQ 1) LTV = sum(LTV,1). IF

(var39 EQ 2) LTV = sum(LTV,1).

compute LCOMP = 0.

IF (var37 EQ 2) LCOMP = sum(LCOMP,1). IF

(var38 EQ 1) LCOMP = sum(LCOMP,1). IF

(var40 EQ 2) LCOMP = sum(LCOMP,1).

Please note: The suggested variable number (to be used with statistical packages) is listed after each statement in the survey. These suggested variable numbers are used in the SPSS command example shown above.

General Skill Level Indicators

The seven items (items 78-84) in Part 8 are direct measures of a student's typical use of computers in school, and are meant to be analyzed individually.

Modified Technology Proficiency Self-Assessment (TPSA) Items

Part 9 consists of eleven items that reflect the following domains (subscales) of proficiency: 1) Electronic Mail, 2) World Wide Web, and 3) Integrated Applications. In addition, a single item assesses proficiency in creating computer graphics. The items associated with each domain are listed in Table 7.

Table 7. Domains of Proficiency.

Domain	Item Number
Electronic Mail	85, 86, 87
WWW	88, 89, 90, 91
Integrated Applications	92, 93, 94
Graphics	95

Scoring Procedures:

1. Generate an average score for each subscale.
 - For each subscale, add all responses and divide by the number of items.
 - An SPSS command example:

`compute electronic mail = (var1+var2+ var4+ . . . +varn)/n.`

Teachers' Attitudes Toward Computers

INTRODUCTION

The Teachers' Attitudes Toward Computers (TAC) questionnaire was developed during 1995-97 for a study of the effects of technology integration education on the attitudes of teachers. The TAC was originally constructed as a 10-part composite instrument that included 284 items spanning 32 Likert and Semantic Differential scales (Christensen & Knezek, 1997). Sets of items were selected from 14 well-validated computer attitude survey instruments during the construction process (Christensen & Knezek, 1996).

Teachers' Attitudes Toward Computers (TAC) questionnaire is a 95-199 item Likert/Semantic Differential instrument for measuring teachers' attitudes toward computers on 7- 20 subscales. Computer Importance and Computer Enjoyment are aligned with similar subscales on the Young Children's Computer Inventory and Computer Attitude Questionnaire. Commonly used versions of the TAC include:

- TAC 2.22 199 item, 16-factor structure plus Loyd & Gressard's Computer Attitude Survey and CAQ Computer Importance and Enjoyment
- TAC 3.0 198 item, 16-factor structure plus Loyd & Gressard's CAS and CAQ Computer Importance and Enjoyment
- TAC 3.2a 105 item 7-factor structure (Form A)
- TAC 3.2b 109 item 7-factor structure (Form B)
- TAC 5.11 95 item 9-factor structure

The TAC (v5.11) is the version of the TAC instrument provided in this book. The first five items in each of the parts 1-7 of this version are the strongest indicators of the 7-factor structure found in the TAC 3.2a and 3.2b.^[1] Placing additional related items in each part, plus the addition of parts 8 and 9, has allowed the authors to retain links (via marker variables and crossover scales) to several historically significant measurement indices in the field. Thus the six additional indices^[2] of Loyd and Gressard's Confidence (Gressard & Loyd, 1986), Pelgrum and Plomp's Enjoyment (Pelgrum, Janssen Reinen, & Plomp, 1993), Pelgrum and Plomp's Relevance

(Pelgrum, Janssen Reinen, & Plomp, 1993), Miyashita and Knezek's Importance (Knezek &

Miyashita, 1993), and Knezek and Miyashita's Anxiety (Knezek & Christensen, 1996), were merged with each other and the seven TAC foundation scales to produce a nine-part instrument. The nine-factor structure of these items is listed in Table 10, along with reliability estimates for each scale. Standard Item Code (SIC) descriptions indicating the original source of each item can be found at the web site of the Institute for the Integration of Technology into Teaching and Learning (www.iittl.unt.edu/sic).

Eight marker items from related U.S. nationwide studies (Soloway, Norris, Knezek, Becker, Riel, & Means, 1999) were also included on the TAC (v5.11). Marker items were placed in the part of the survey containing the scale with which they had the highest content (face value) validity. Future research is needed to determine if the marker variables contribute to one of the TAC scales. These items and their sources are listed in Tables 8 and 9.

Table 8. Becker Study (1999) Items Included on TAC 5.11

Part and Item No.	Item
Part 1 - 10	The people who give me the best ideas for improving teaching also tend to know a lot about computers.
Part 2 - 10	Computers are hard to figure out how to use.
Part 9 - 8	Students work harder at their assignments when they use computers.
Part 9 - 9	Students help one another more while doing computer

Table 9. Norris & Soloway Snapshot Survey (1999) Items Included on TAC 5.11

Part and Item No.	Item
Part 1 - 12	I believe that I am a better teacher with technology.
Part 5 - 10	The internet will help narrow the societal gap between the "haves" and "have nots".
Part 9 - 7	Computers can help accommodate different learning styles.
Part 9 - 10	Students' time on the Internet is time well-spent.

RECOMMENDED ADMINISTRATION PROCEDURES

This questionnaire is composed of well-validated portions of several attitudinal surveys that have been used with teachers in the past. Administration normally requires 10-15 minutes. Each part can be administered as a stand-alone module if desired.

TAC INTERNAL CONSISTENCY RELIABILITY

Internal consistency reliability estimates for the 9 parts of the TAC, based on data from 550 teachers in a large metropolitan, is provided in Table 10. All 9 TAC scales appear to be "very good" according to the guidelines provided by DeVellis (1991).

Scale	Alpha	Number of Items	N cases
Part 1 - Interest	.91	10	520
Part 2 - Comfort	.94	9	533
Part 3 - Accommodation	.84	11	523
Part 4 - Interaction (Electronic mail)	.96	10	522
Part 5 - Concern	.89	10	530
Part 6 - Utility	.93	10	525
Part 7 - Perception	.97	7	520
Part 8 - Absorption	.89	10	532
Part 9 - Significance	.93	10	525

Note: Reliability estimates are based on data gathered from 550 K-12 teachers in a large metropolitan school district in Texas during April - May, 2000.

STUDIES AND REPORTS USING TAC

Christensen, R., & Knezek, G. (2000). *Refining the Teachers' Attitude Toward Computers Questionnaire*. In C. Morales, G. Knezek, R. Christensen, & P. Avila (Eds.), *Impact of new technologies on teaching and learning* (pp.27-44). Mexico City: Instituto Latinoamerica de la Comunicacion Educativa.

Christensen, R., & Knezek, G. (1998). *Parallel Forms for Measuring Teachers' Attitudes Toward Computers*. Presented at Society of Information Technology & Teacher Education (SITE) 9th International Conference, Washington, DC, March 13, 1998.

Christensen, R., & Knezek, G. (1996). *Constructing the Teachers' Attitudes Toward Computers (TAC) Questionnaire*. ERIC Document Reproduction Service No. ED398244.

Christensen, R., & Knezek, G. (1997). *Internal consistency reliabilities for 14 computer attitude scales*. In *Teacher and Teacher Education Annual 1997*. Charlottesville: Association for the Advancement of Computing in Education.

Knezek, G., & Christensen, R. (1997). *Attitudes Toward Information Technology at Two Parochial Schools in North Texas*. Denton, TX: Texas Center for Educational Technology.

SCORING THE TAC (v5.11) QUESTIONNAIRE

The Teachers' Attitudes Toward Computers (TAC v5.11) gathers data on nine separate indices from respondents. TAC is a 95 item Likert/Semantic Differential instrument for measuring teachers' attitudes toward computers. Marker variables were included in the instrument to enable comparison with other researchers' findings. These marker variables are not validated parts of these scales. This version (TAC v5.11) includes the well-validated semantic differential subscale Semantic Perception of Computers (Kay, 1993) from The Computer Attitude Measure (CAM). The following sections describe how to compile scale scores from each of the nine parts of the instrument.

Teachers' Attitudes Toward Computers Likert Measurement Scales

The nine scales are Interest, Comfort, Accommodation, Interaction (Electronic mail), Concern, Utility, Perception, Absorption, and Significance. The items of the scales are distributed among the parts of the TAC as follows

Table 11. Subscale to Item Number Conversions

Scale	No. of items	Part	Item Number
Interest	9	1	1,2,3,4,5,6,7,8,11
Comfort	8	2	1,2,3,4,5,6,7,8
Accommodation	11	3	1,2,3,4,5,6,7,8,9,10,11
Interaction (Electronic mail)	10	4	1,2,3,4,5,6,7,8,9,10
Concern	10	5	1,2,3,4,5,6,7,8,9,11
Utility	10	6	1,2,3,4,5,6,7,8,9,10
Perception	7	7	1,2,3,4,5,6,7
Absorption	10	8	1,2,3,4,5,6,7,8,9,10
Significance	10	9	1,2,3,4,5,6,11,12,13,14

Step-by-Step Scoring Procedures

The recommended procedure for manual scoring is to simply average the numeric values of the responses for the related items to produce the various scale scores. However, some items on the TAC have negative wording and must be reversed before combining with the others (see Table 12). If the respondent selected 1 or SD (Strongly Disagree), change it to 5 or SA (Strongly Agree). If the respondent circled 4 or A (Agree), change it to 2 or D (Disagree). To generate an average for each subscale, take the sum of the items and divide by the number of items.

Table 12. Item Numbers to be Reversed in Each Subscale.

Scale	Part	Item Number to be Reversed
Interest	1	4
Comfort	2	1,2,3,4,5,7,10
Accommodation	3	1,2,3,4,5,8,9,10,11
Concern	5	1,2,3,4,5,6,7,8,9,11
Absorption	8	5,8

Step-by-Step Scoring Procedures:

1. Reverse the items negatively worded within each subscale.

- Many of the items in the TAC (v5.1x) subscales have negative wording.

- To ensure that this alternate positioning does not invalidate summed scores, the scoring process must include the reversal (reflection) of items negatively worded.

- An SPSS command example:

```
compute varx = 6 - varx
```

(where x is the variable that represents the item in the scale and where 6 is used for any 5-position scale)

2. Generate an average score for each subscale.

- Add all values for each subscale and divide by the number of items.

- An SPSS command example (see Instrument in appendix for standard item code variable numbers):

```
compute Interest = (var186+var103+var211+var180+var181+var10+var9+var12+var4)/9
```

Computer Attitude Measure (CAM) Semantic Differential Scale

Kay's (1993) Computer Attitude Measure has 7 adjective pairs with seven response blanks.

Step-by-Step Scoring Procedures:

Translate each response (X) to a numerical value

Each blank on the response form represents a value from 1-7. For example, an X in the 2nd blank from the left is valued at 2.

Generate an average score

- Add all 7 values and divide by the number of items.
- An SPSS command example:

```
compute Perception = (var41+var42+var43+ . . . +varn)/n
```

Please note: The suggested variable number (to be used with statistical packages) is listed after each statement in the survey. These suggested variable numbers are used in the SPSS command examples shown above.

Teachers' Attitudes Toward Information Technology

INTRODUCTION

The Teachers' Attitudes Toward Information Technology (TAT v2.01) complements the Teachers' Attitudes Toward Computers (TAC) to provide assessment in New Information Technologies. It is constructed primarily from semantic differential items using Teachers' Attitudes Toward Information Technology (v2.0) statements such as "to me Electronic mail is important/unimportant". Teachers' Attitudes Toward Information Technology addresses the following areas: Electronic mail, multimedia, the World Wide Web, teacher productivity, and classroom productivity for students.

RECOMMENDED ADMINISTRATION PROCEDURES

This instrument requires 5-8 minutes to complete. Sometimes teachers are unfamiliar with the semantic differential format and need to be told to mark their first impression quickly, without contemplating very long. This form works best when a general "aura" about some aspect(s) of the Internet, such as Electronic mail or the World Wide Web, is sought.

TAT INTERNAL CONSISTENCY RELIABILITY

Internal consistency reliability estimates for scales on the TAT are listed in Table 13. These all fall above the range of "very good" according to the guidelines provided DeVellis (1991).

Subscales	Alpha	No. of Variables
Electronic mail (teacher)	.93	10
WWW (teacher)	.95	10
Multimedia (teacher)	.96	10
Productivity (teacher)	.96	10
Productivity (students)	.96	10

Knezek, G., & Christensen, R. (1998). Internal Consistency Reliability for the Teachers' Attitudes Toward Information Technology (TAT) Questionnaire. *Proceedings of the Society for Information Technology & Teacher Education*, 2, 832-833.

STUDIES AND REPORTS USING TAT

Christophel, J., Hardy, C., Johnson, D., Kramer, K., Knezek, G., & Williams, S. (1998). *Analysis of Personality Types and Attitudes Toward Information Technology*. [Online]

Available: <http://courseweb.tac.unt.edu/gknezek/personty.htm>.

Knezek, G., & Christensen, R. (1998). *Internal Consistency Reliability for the Teachers' Attitudes Toward Information Technology Questionnaire*. Presented at the Society of Information Technology & Teacher Education (SITE) 9th International Conference, Washington, DC, March 13, 1998.

Knezek, G., & Christensen, R. (1997). *Internal Consistency Reliability for the Teachers' Attitudes Toward Information Technology (TAT) Questionnaire*. Denton, TX: Texas Center for Educational Technology.

Knezek, G., & Christensen, R. (1997). *Attitudes Toward Information Technology at Two Parochial Schools in North Texas*. Denton, TX: Texas Center for Educational Technology.

Knezek, G., & Christensen, R. (1998). *Attitudes Towards Information Technology Among Teachers at Six Texas Middle Schools*. Denton, TX: Texas Center for Educational Technology.

SCORING THE TAT (v2.01) QUESTIONNAIRE

The Teachers' Attitudes Toward Information Technology (TAT v2.01) Questionnaire gathers data on five separate indices from respondents. These five subscales were newly constructed using semantic differential items from Zaichkowsky's (1985) Modified Personal Involvement Inventory, a context free 16-item semantic differential scale that focuses on "a person's perceived relevance of the object based on inherent needs, values, and interests" (p. 342). The following sections describe how to score each subscale.

Semantic Differential Items

Semantic items are typically hand coded with a number from 1-7, representing the particular space the respondent marked between the adjective pairs, then keypunched by data entry staff. An example semantic differential scale is listed in Figure 1.

To me, Electronic Mail is:

1	Important	<input type="radio"/>	Unimportant						
2	Boring	<input type="radio"/>	Interesting						
3	Relevant	<input type="radio"/>	Irrelevant						
4	Exciting	<input type="radio"/>	Unexciting						
5	Means nothing	<input type="radio"/>	Means a lot						
6	Appealing	<input type="radio"/>	Unappealing						
7	Fascinating	<input type="radio"/>	Mundane						
8	Worthless	<input type="radio"/>	Valuable						
9	Involving	<input type="radio"/>	Uninvolving						
10	Not needed	<input type="radio"/>	Needed						

Figure 1. Sample Semantic Differential scale from the TAT Questionnaire.

The TAT (v2.01) is based on item pairs from Zaichkowsky's (1985) Modified Personal Involvement Inventory. It includes five semantic perception scales on the following target items:

1. Electronic mail for me,
2. WWW for me,
3. Multimedia for me,
4. Computers for Professional Productivity, and
5. Computers in the Classroom.

Step-by-Step Scoring Procedures:

Four items in each TAT (v2.0x) scale have the "negative" adjective in the left-hand or first position, while the other six have the "positive" adjective in the first position. This "alternate" design ensures that respondents do not simply place X in all the right-hand blanks for an object.

Reverse the items negatively worded within each scale.

- To ensure that this alternate positioning does not invalidate summed scores, the scoring process must include reversal (reflection) of items negatively worded.
- For ease in interpretation, responses toward "positive" adjectives show high values, and responses toward "negative" adjectives show low values.
- Reverse the following items: 1, 3, 4, 6, 7, and 9 in EACH of the five scales.
- Please note: Each of the five subscales consists of items numbered from 1 to 10. However, when using a statistical package, like SPSS, we recommend using the variable numbers beginning with 1 and continue to 50.
- An SPSS command example:

```
compute varx = 8 - varx.
```

(where x is the variable that represents the item in the scale and where 8 is used for any 7-position scale)

- SPSS command application:

```
compute var1 = 8 - var1.
```

```
compute var3 = 8 - var3. compute
```

```
var4 = 8 - var4. compute var6 = 8
```

- var6. compute var7 = 8 - var7.

compute var9 = 8 - var9. compute

var11 = 8 - var11. compute var13 =

8 - var13. compute var14 = 8 -

var14. compute var16 = 8 - var16.

compute var17 = 8 - var17.

compute var19 = 8 - var19.

compute var21 = 8 - var21.

compute var23 = 8 - var23.

compute var24 = 8 - var24.

compute var26 = 8 - var26.

compute var27 = 8 - var27.

compute var29 = 8 - var29.

compute var31 = 8 - var31.

compute var33 = 8 - var33.

compute var34 = 8 - var34.

compute var36 = 8 - var36.

compute var37 = 8 - var37.

compute var39 = 8 - var39.

compute var41 = 8 - var41.

compute var43 = 8 - var43.

compute var44 = 8 - var44.

compute var46 = 8 - var46.

compute var47 = 8 - var47.

compute var49 = 8 - var49.

missing values var1 var3 var4 var6 var7 var9(8). var11
var13 var14 var16 var17 var19(8)
var21 var23 var24 var26 var27 var29(8) var31
var33 var34 var36 var37 var39(8) var41 var43
var44 var46 var47 var49(8)

Generate an average score for each subscale.

- Add all 10 responses and divide by the number of items.
- An SPSS command example:

compute email = (var1+var2+var3+...+varn)/n.

- SPSS command application:

compute S1 = (var1+var2+var3+var4+var5+var6+var7
+var8+var9+var10)/10.

compute S2 = (var11+var12+var13+var14+var15+var16+var17
+var18+var19+var20)/10.

compute S3 = (var21+var22+var23+var24+var25+var26+var27
+var28+var29+var30)/10.

compute S4 = (var31+var32+var33+var34+var35+var36+va37
+var38+var39+var40)/10.

compute S5 = (var41+var42+var43+var44+var45+var46+var47
+var48+var49+var50)/10.

Faculty Attitudes Toward Information Technology

INTRODUCTION

The Faculty Attitudes Toward Information Technology (FAIT v1.1) questionnaire provides assessment of university and college faculty attitudes toward new information technologies. It includes subscales from Teachers Attitudes Toward Computers (TAC 3.2a), such as electronic mail use for instruction, plus background questions tailored for university faculty.

RECOMMENDED ADMINISTRATION PROCEDURES

This instrument is a subset of the 7-factor structure of the TAC, with the items rearranged in scale order. As a result, it is quick and reliable and can be used as several scales independently. Normal completion time is less than 15 minutes.

FAIT INTERNAL CONSISTENCY RELIABILITY

Internal consistency reliability estimates for the FAIT, bases on data from 218 university faculty in 1998, are presented in Table 14. Scale reliabilities fall in the range of "respectable" to "very good" according to the guidelines provided by DeVellis (1991).

Table 14. Internal Consistency for 7-Factor Structure of the FAIT

Subscales	Alpha	No. of Variables
Enthusiasm (F1)	.96	15
Anxiety (F2)	.98	15
Avoidance (F3)	.74	6
Electronic mail (F4)	.95	11
Negative Impact on Society (F5)	.84	10
Classroom Learning Productivity (F6)	.90	14
Kay's Semantic (F7)	.94	10

Gilmore, Elizabeth L. (1998). Impact of training on the attitudes of university faculty in the use of technology. p. 21. Doctoral dissertation, University of North Texas, Denton, Texas.

STUDIES AND REPORTS USING FAIT

Knezek, G., Christensen, R., Gilmore, E., Kim, H., Morales, C., Voogt, J., & Moonen, B. (1999). *Teacher and student attitudes toward information technology in four nations*. Panel presentation at Society of Information Technology & Teacher Education (SITE) 10th International Conference, San Antonio, TX, March 2, 1999.

Soloway, E., Norris, C., Knezek, G., Becker, H., Riel, M., & Means, B. (1999). *The relationship of teachers and technology: Survey findings and reflections*. Panel presentation at Society of Information Technology & Teacher Education (SITE) 10th International Conference, San Antonio, TX, March 3, 1999.

Gilmore, Elizabeth Lee. (1998). *Impact of training on the information technology attitudes of university faculty*. Doctoral dissertation. University of North Texas, Denton.

SCORING THE FAIT (v1.1) QUESTIONNAIRE

The Faculty Attitudes Toward Information Technology (FAIT v1.1) questionnaire gathers data on five separate indices from respondents. FAIT is drawn from a subset of the Teachers' Attitudes Toward Computers questionnaire which is a 95-199 item Likert/Semantic Differential instrument for measuring teachers' attitudes toward computers. The subset (TAC v3.2a) uses 105 items to gather data on seven factors: Enthusiasm, Anxiety, and Avoidance, Electronic mail for Classroom Learning, Negative Impact on Society, Productivity Improvement, and Semantic Perception of Computers.

Faculty Attitude Toward Information Technology - Subscales

The FAIT (v1.1) uses 68 items on a 5-point Likert instrument to gather data on five factors: Enthusiasm/Enjoyment (F1), Anxiety (F2), Productivity Improvement (F6), Avoidance (F3) and Electronic Mail Use for Classroom Learning (F4). The following sections describe how to score each scale.

The recommended procedure for manual scoring is to simply average the numeric values of the responses for the related items to produce the various scale scores. However, some items on the FAIT have negative wording and must be reversed before adding to the others. These items are listed below in the "SPSS command application". If the respondent

selected 1 or SD (Strongly Disagree), change it to 5 or SA (Strongly Agree). If the respondent selected 4 or A (Agree) change it to 2 or D (Disagree). For example, the subscale Enthusiasm/Enjoyment (F1) will be the sum of 15 items (item 1 through item 15), with items 12, and 14 reversed before inclusion in the sum. To generate an average for each subscale, take the sum of the items and divide by the number of items.

Please Note: The item number and the variable number (to be used with statistical packages) are the same.

Step-by-Step Scoring Procedures:

Reverse the items negatively worded within each subscale.

- Twenty two (22) items in the FAIT (v1.x) subscales have negative wording. These items are listed below in the "SPSS command application".
- To ensure that this alternate positioning does not invalidate summed scores, the scoring process must include the reversal (reflection) of items negatively worded.
- An SPSS command example:

 compute varx = 6 - varx.
 (where x is the variable that represents the item in the scale and where 6 is used for any 5-position scale).
- SPSS command application:

 COMPUTE var12=6-var12.
 COMPUTE var14=6-var14.
 COMPUTE var16=6-var16.
 COMPUTE var17=6-var17.
 COMPUTE var18=6-var18.
 COMPUTE var19=6-var19.
 COMPUTE var20=6-var20.
 COMPUTE var22=6-var22.
 COMPUTE var23=6-var23.
 COMPUTE var24=6-var24.
 COMPUTE var25=6-var25.
 COMPUTE var27=6-var27.
 COMPUTE var29=6-var29.
 COMPUTE var46=6-var46.

```
COMPUTE var47=6-var47.  
COMPUTE var48=6-var48.  
COMPUTE var49=6-var49.  
COMPUTE var50=6-var50.  
COMPUTE var51=6-var51. COMPUTE  
var54=6-var54. COMPUTE var55=6-  
var55. COMPUTE var57=6-var57.
```

```
MISSING VALUES var12 var14(6)  
var16 var17 var18 var19 var20 var22 var23 var24 var25 var27 var29(6)  
var46 var47 var48 var49 var50 var51 var54 var55 var57(6).
```

Generate an average score for each subscale.

- Add all values for each subscale and divide by the number of items.
- An SPSS command example:

```
compute J = (var1+var2+var4+.. +varn)/n.
```

- SPSS command application:

```
compute F1=(var1+var2+var3+var4+var5+var6+var7  
+var8+var9+var10+var11+var12+var13+var14+var15)/15.
```

```
compute F2=(var16+var17+var18+var19+var20+var21+var22+var23  
+var24+var25+var26+var27+var28+var29+var30)/15.
```

```
compute F3=(var46+var47+var48+var49+var50  
+var51+var52+var53+var54+var55+var56+var57)/12.
```

```
compute F4=(var58+var59+var60+var61+var62+var63  
+var64+var65+var66+var67+var68)/11.
```

```
compute F6=(var31+var32+var33+var34+var35+var36  
+var37+var38+var39+var40+var41+var42+var43+var44+var45)/15.
```

Please note: The suggested variable number (to be used with statistical packages) is listed after each statement in the survey. These suggested variable numbers are used in the SPSS command example shown above.

Concerns - Based Adoption Model - Levels of Use

INTRODUCTION

The Concerns-Based Adoption Model - Levels of Use (CBAM-LoU v1.1) instrument is a quick self-assessment measure. It is targeted toward describing behaviors of innovators as they progress through various levels of use - from non-use, to managing, and finally to integrating use of the technology. It does not focus on attitudinal, motivational, or other affective aspects of the user.

The instrument is based on the eight levels of use defined in the Levels of Use Chart (Loucks, Newlove, & Hall, 1975). The levels of use are: (0) Non-Use, (I) Orientation, (II) Preparation, (III) Mechanical Use, (IVA) Routine, (IVB) Refinement, (V) Integration, and (VI) Renewal. The concept of levels of use also applies to groups and entire institutions. The instrument is time efficient to use as an indicator of an educator's progress along a technology utilization continuum.

RECOMMENDED ADMINISTRATION PROCEDURES

This instrument is a quick self-report measure for use in assessing the level of technology utilization. This instrument describes the various behaviors of the innovation user through eight levels. The user selects a single level that best describes his/her level of technology use. Normal completion time is less than 5 minutes.

CBAM-LOU INTERNAL CONSISTENCY RELIABILITY

Because the Concerns-Based Adoption Model - Levels of Use is a single item survey, internal consistency reliability measures cannot be calculated for data gathered through it.

STUDIES USING CBAM - LOU

Knezek, G., & Christensen, R. (2000). *Refining Best Teaching Practices for Technology Integration: KIDS Project Findings for 1999 -2000*. Denton, TX: University of North Texas.

Stages of Adoption of Technology

INTRODUCTION

The Stages of Adoption of Technology (Stages v1.1) instrument is a quick self-assessment measure. It has been used in both pre-service and in-service education to measure the impact of information technology training as well as trends over time. It is derived from the stages presented by Russell (1995) in research assessing adults learning to use electronic mail. Russell's stages included: (1) awareness, (2) learning the process, (3) understanding the application of the process, (4) familiarity and confidence, (5) adaptation to other contexts, and (6) creative applications to new contexts. In the Stages of Adoption of Technology instrument (Christensen, 1997; Christensen & Knezek, 1999) the stage descriptions are generalized to make them appropriate for any information technology.

The instrument is a fast and efficient one-time report with many possible applications. For example, it may be useful to determine the average stage for teachers in a school in order to target the initial level of a new school-wide training program. It could be useful as a pre/post technology integration training program measure for professional development. Instructors in a university course that includes technology may find the Stages instrument helpful for pre/post assessment of changes during the semester. The instrument is time efficient, reliable, and valid as an indicator of an educator's progress along a technology integration continuum.

RECOMMENDED ADMINISTRATION PROCEDURES

This instrument is a quick and reliable self-report measure for use in assessing technology integration. The user selects a single stage that best describes his/her stage of adoption. Normal completion time is less than 5 minutes.

STAGES RELIABILITY

Because the Stages of Adoption of Technology instrument is a single item survey, internal consistency reliability measures cannot be calculated for data gathered through it. However, a high test-retest reliability estimate (.91) was obtained from a sample of 525 K-12 teachers from a metropolitan north Texas public school district during August 1999. The Stages of Adoption of Technology item was included on two attitudinal questionnaires that were completed by educators as near to each other in time as within the same hour, or separated in time by as much as one day. During this process educators never had access to the information provided on one survey while completing the other.

A Pearson product-moment correlation was calculated between the two reported Stage measures as a form of test-retest reliability. The resulting value of .91 indicates high consistency for these educators on reported stages, within the recognized limitations (remembering the contextual cues) that undoubtedly inflated the estimate, compared to a standard reliability index.

STUDIES USING STAGES OF ADOPTION OF TECHNOLOGY

Christensen, R. (1997). *Effect of technology integration education on the attitudes of teachers and their students*. Doctoral dissertation, University of North Texas.

Christensen, R., & Knezek, G. (1999). Stages of adoption for technology in education. *Computers in New Zealand Schools*, 11(3), 25-29.

Knezek, G., & Christensen, R. (2000). *Refining Best Teaching Practices for Technology Integration: KIDS Project Findings for 1999 - 2000*. Denton, TX: University of North Texas.

Technology in Education Competency Survey (TECS)

INTRODUCTION

Technology in Education Competency Survey (TECS v1.1) (Christensen, 1999) is a self-assessment rating form covering teacher competencies in nine major areas addressed by the National Council for the Accreditation of Teacher Education (NCATE) standards for the USA.

RECOMMENDED ADMINISTRATION PROCEDURES

This instrument is a quick and reliable self-report measure for use in assessing technology competency in nine major areas. Normal completion time is less than 5 minutes.

TECS INTERNAL CONSISTENCY RELIABILITY

This direct appraisal, 9-item form has yielded an internal consistency reliability estimate of .92 across 188 pre-service educators and 40 university faculty (Christensen & Knezek, 2000).

STUDIES USING TECS

Christensen, R., & Knezek, G. (2000). *Internal consistency reliability for the Technology in Education Competency Survey*. Presentation to the Preparing Tomorrow's Teachers Evaluator's Workshop, American Educational Research Association Annual Meeting, New Orleans, LA, April 25, 2000.

Technology Proficiency Self-Assessment

INTRODUCTION

The *Technology Proficiency Self-Assessment* (TPSA v1.0; Ropp, 1999) is a 20-item Likert-type instrument. It was designed to reflect four domains included in the International Technology in Education (ISTE) National educational technology standards for teachers. The self-assessment consists of 20 items, 5 each from the following domains of proficiency: 1) Electronic mail, 2) World Wide Web, 3) Integrated Applications, and 4) Integrating Technology into Teaching.

The TPSA was also designed to provide individuals with examples of the variety of ways that a proficient teacher candidate might use computers and technology in the classroom. In this manner, the TPSA could be used by a teacher candidate as a tool that would provide examples of technology proficiency as well as indicate progress toward proficiency.

Even though the content of the items on the Technology Proficiency Self-Assessment was tailored to teaching and learning with computers, the TPSA is essentially a measure of self-efficacy. Individuals are asked to rate their confidence in their ability to perform the tasks listed on the instrument.

RECOMMENDED ADMINISTRATION PROCEDURES

The *Technology Proficiency Self-Assessment* (TPSA) is a 20-item Likert-type instrument. For the original version, the subjects rated each item on a scale from 1 to 6, where a high number represented high confidence in performing several tasks related to using technology in teaching. The version presented in this book uses 5-point Likert descriptors in a "strongly disagree" to "strongly agree" format.

TPSA INTERNAL CONSISTENCY RELIABILITY

The *Technology Proficiency Self-Assessment* (TPSA) was developed to reflect the domains that form the basis for the Michigan State University College of Education Technology Proficiency Checklist. Usable responses were received from 47 students. The scale was found to have a reliability of $\alpha = .95$. In a more recent study, the entire instrument was found to have a reliability α of .94 from a set of responses from 506 in-service teachers. Alphas were also

determined for each of the four subscales: Electronic mail (.78), WWW (.81), Integrated Applications (.84) and Teaching with Technology (.88).

STUDIES USING TPSA

Ropp, M. M. (1997). *Exploring individual characteristics associated with learning to use computers and their use as pedagogical tools in pre-service teacher preparation*. Doctoral dissertation. Michigan State University.

Ropp, M. M. (1999). Exploring individual characteristics associated with learning to use computers in pre-service teacher preparation. *Journal of Research on Computing in Education*, 31(4), 402-424.

SCORING THE TPSA

The recommended TPSA (v1.x) scoring procedure is to simply average the numeric values of the responses for the related items to produce the a score for each of the domain subscales, Electronic mail, World Wide Web, Integrated Applications and, Integrating Technology into Teaching.

Generate an average score for each subscale.

- For each subscale, add all responses and divide by the number of items,
- An SPSS command example:

Compute electronic mail = (var1+var2+var4+..+varn)

Glossary

Attitudes Toward School

perceived value or significance of school

Computer Enjoyment

amount of pleasure derived from using computers

Computer Importance

perceived value or significance of knowing how to use computers

Creative Tendencies

inclinations toward exploring the unknown, taking individual initiative, finding unique solutions

Empathy

a caring identification with the thoughts or feelings of others

Likert Scale

a measure which asks a person to circle (check) the agreement to a statement (e.g., strongly agree, agree, undecided, disagree, strongly disagree)

Motivation

increasing effort; perseverance; never giving up

Paired Comparison

a forced choice between two alternatives (e.g., I would rather [a] read a book [b] watch TV)

Scale

a numbering system used to order or rank values

Study Habits

mode of pursuing academic exercises within and outside class

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[1] During 1999-2000, responses from 1296 Texas educators were used to reconfirm the original seven constructs measured by the Teachers' Attitudes Toward Computers Questionnaire. An exploratory factor analysis of the 106 items from March 1998 data reconfirmed the TAC's original (1997) 7-factor structure. Internal consistency reliabilities ranged from .87 to .95 for the new data, using the original seven scales.