# The Impact of a Federally Funded Grant on a Professional Development Program: Teachers' Stages of Concern Toward Technology Integration

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***Abstract***

*This study investigated the effects of a teacher professional development program funded by a No Child Left Behind (NCLB) grant on program participants' (teachers') stages of concern toward instructional technology integration into curriculum. The study also explored potential differences in the concern levels among the participants from different age groups, school levels and gender. The data analyses of the pre-/post-/follow-up survey responses submitted by 377 participants revealed that the program was quite successful in reducing participants' self-based concerns while increasing their impact-based concerns about technology integration. This was a very encouraging profile, according to the Concerns-Based Adoption Model (CBAM). Participants' ages reflected differential concern levels at some stages, whereas the school level they taught had no influence on this issue.*

## Introduction

The importance of training teachers to use educational technology has been recognized for more than 2 decades. For example, more than 20 years ago, Hagey (1985) noted that trained teachers usually provided their students with more computer time and showed more confidence in their ability to use computers. According to Johnson (1988), hands-on training with peers on relevant topics is the preferred type of stimuli for incorporating computer use in schools. A decade ago, the CEO Forum (1999) recommended that every professional development program nationwide integrate technology as a part of all training components, and that new teacher and administrator licensure and certification programs should require proficiency in integrating technology into the curriculum by 2003. Galagan (1999) also argued that many teachers were unable to integrate technology into their lessons because of lack of training. Rogers (2000) posited that the application of technology could be complicated and time consuming until mastery is reached through training. Therefore, it makes sense that teachers who spent more time in professional development activities and who felt well prepared to use technology for teaching were generally more likely to use it than those who felt unprepared (Smerdon et al., 2001).

In response to the need to train teachers to effectively use educational technology in elementary and secondary education, the federal NCLB initiative included 5-year competitive grants for Enhancing Education Through Technology (NCLB-EETT). One of the grants was awarded to the Consortium for Interactive Instruction (CII), anchored by WHRO, a National Public Television Station in southeastern Virginia. For the past 6 years, WHRO has been managing the distribution of a series of curriculum-based instructional technology integration courses to PK–12 teachers, most of which are delivered as 6-week asynchronous online courses. The grant enables any teacher or administrator in the regional consortium of 18 school divisions to enroll in the courses free of charge, and the courses can satisfy teacher professional development requirements. The authors designed the original evaluation plan submitted with the grant application and were subsequently asked by WHRO to conduct the evaluation, which led to the present study. One of the evaluation components was to identify changes in participant attitudes over time by tracking and comparing participants' stages of concern before and after the training. (Appendix A on page 54 illustrates the entire evaluation plan.)

The Stages of Concern (SoC) dimension, which originated from a conceptual framework known as the Concerns-Based Adoption Model (CBAM) based on work by Fuller (1969), quantifies how individuals or groups perceive an innovation and how they feel about its use in their work (Hall & Hord, 1987). Concern is defined by Hall, George, and Rutherford (1977) as "the composite representation of the feelings, preoccupation, thought, and consideration given to a particular issue or task" (p. 5). According to Hall and Hord, there is a set of developmental stages of concern that teachers move through as they become increasingly sophisticated and skilled in using new programs and procedures, from early "self" concerns, to "task" concerns, and finally to "impact" concerns. Correspondingly, seven sequential stages are identified: (a) Awareness, (b) Informational, (c) Personal, (d) Management, (e) Consequence, (f) Collaboration, and (g) Refocusing. The first three stages are "self" types of concerns that focus on teachers' internal concerns such as personal knowledge, involvement, and ability. The fourth stage is "task" oriented, as it addresses the logistics and scheduling arrangements with regard to the use of the innovation. The last three stages are "impact" kinds of concerns that deal with teachers' external concerns about how the innovation may affect their students, colleagues, and future work.

Various factors affect these stages of concern. For example, age might be negatively related to the stages of concern in technology application. Atkins and Vasu (2000) found that younger teachers tended to score higher on the Teaching with Technology Instrument (TTI), and that those who had elevated scores on the impact stages of concern about computers also had higher mean scores on the TTI. Therefore, it is very likely that younger teachers would have more intense concerns at the impact stages. Along the same line, Ayersman and Reed (2001) reported that the most recent college students usually had the lowest concerns at almost all stages except Awareness. The results from a qualitative study by Goodwyn, Adams, and Clarke (1997) suggested that older teachers belong to the "fearful" group, for whom technology is generally a threat and the cause of much anxiety.

Teachers' stages of concern might also be associated with the grade levels they teach. Cheung and Ng (2000) investigated teachers' concerns about the Target-Oriented Curriculum (TOC) project in Hong Kong and found that most primary school teachers had peak concerns at the Management, or task, stage: They were most worried about issues such as efficiency, time demands, organization, scheduling, and the best use of

resources. No literature was identified that compared teachers' concerns at elementary, middle, and high school levels.

Perhaps the most important factor that determines a teacher's stages of concern is his or her confidence and competence in using an innovation. After examining middle school teachers' concerns, knowledge, and use of technology in teaching, Atkins and Vasu (2000) concluded that teachers with more computer confidence exhibit elevated scores on the impact stages. Cheung, Hattie, and Ng (2001) found significant interaction between teaching experience with TOC and the stages of concern: Non-users had more intense concerns at Stage 0 (Awareness), whereas experienced TOC teachers expressed more intense concerns at the impact stages.

The purpose of this study was to investigate whether the 6-week PBS Teacherline professional development courses, as well as the 1-week summer workshops offered by the Consortium for Interactive Instruction (CII) and funded by the NCLB grant, caused any changes in participants' concerns profiles. Specifically, we wanted to find out whether the course participants would, over time, experience decreases in their internal, or self-based, concerns and increases in their external, impact-based concerns.

Even though this study included a wide variety of courses, it followed a consistent pedagogy that, if shown to be effective, can serve as a design model for future instructional technology professional development efforts. This aspect of the study addresses Roblyer and Knezek's (2003) call for broad-spectrum research to identify effective strategies educational technology trainers and practitioners can use to enhance technology implementation. We also investigated potential differences in the levels of concerns among participants from different age groups, school levels, and gender.

Four research questions framed this study:

1. What effects do the professional development courses have on participants' stages of concern toward instructional technology integration?
2. Are there differences between age groups in participants' stages of concern toward instructional technology integration?
3. Are there differences based on gender in participants' stages of concern toward instructional technology?
4. Do participants' stages of concern toward instructional technology integration vary based on the school levels they teach?

## Method

This study was basically a quantitative design with pre/post/follow-up measures. To triangulate the data and extend the inquiry into resulting classroom practice, we also collected qualitative data from interviews with program participants.

### *Treatment*

The WHRO–CII consortium offers 6-week-long PBS Teacherline courses free of charge (funded by the NCLB-EETT grant) to anyone employed by the 18 member school districts. The design and structure of these online asynchronous courses are based on contemporary design elements such as: (a) facilitator–participant interaction via a discussion board and e-mails to create a supportive academic learning community, (b) regularly scheduled asynchronous threaded discussion to explore various course topics in depth, (c) session assignments, and (d) a final project reflecting the overall goals and objectives of the course. The final project was almost ubiquitously a lesson plan that incorporated appropriate state and professional standards and technology-reliant instructional strategies. Most courses can satisfy teacher professional development requirements, as determined by individual school districts. Each course is expected to take either 15–20 hours or 30 hours to complete. Notably, the courses that the consortium selects from the PBS Teacherline catalog are facilitated locally, which means the facilitators are part of the local school systems and therefore understand the teaching and learning environments of the course participants as well as the Virginia Standards of Learning (SOL).

In addition to the online courses, the WHRO/CII consortium also offers face-to-face technology immersion courses, Tech Trek I and Tech Trek II. These weeklong summer courses incorporate the same learner-centered pedagogical elements as the PBS Teacherline courses, except that most interaction is face to face rather than through distributed communication media. These courses are designed to increase participants' technical competence and help them develop technology-enhanced curricula. Participants are provided with intensive hands-on technology experience guided by the course facilitators and assisted by computer lab assistants.

### *Sample*

The sample of this study was the PK–12 inservice teachers who (a) voluntarily took one or more of the grant-funded courses (either online or face to face) during the 3rd and 4th grant fiscal years (2004–2006) and (b) completed all three surveys (pre-/post-/follow-up surveys). Of the total 377 participants involved in this study, 58 (15%) were male teachers and 319 (85%) were females. One hundred seventy-one (45%) participants taught in PK–6 schools, 79 (21%) taught in middle schools, 82 (22%) taught in high schools, and 45 (12%) worked in other educational institutions such as private and religious schools. In terms of participants' age, 16 (4%) were younger than 25 years old, 52 (14%) were between 25 and 30, 83 (22%) were between 31 and 40, 117 (31%) were between 41 and 50, and 109 (29%) were more than 50 years old.

### *Instruments*

***Stages of Concern.*** Hall et al. (1977) developed the SoC questionnaire to measure the evolution of teachers' attitudes toward an educational innovation. The instrument was selected on the premises that teachers' exhibited levels of concerns indicate their stage of instructional technology implementation, and that if teachers' concerns profiles, measured over time, reflect a maturation of instructional technology adoption, then the pedagogy of the grant-funded professional development courses is effective.

Hall et al. identified seven types of concerns that learners of an innovation may experience and organized them as seven stages of concern, implying a developmental progression from low-level to high-level concerns. The first stage, Awareness, indicates a teacher's level of interest or involvement in the innovation. The second stage, Information, addresses a teacher's desire to learn about the innovation. The third stage, Personal, reflects a teacher's concern about how the innovation would affect him or her personally. The fourth stage, Management, refers to the process and tasks of using the innovation, such as organizing, managing, scheduling, and time demands. The fifth stage, Consequence, addresses a teacher's perception of the impacts of the innovation on students' learning. The sixth stage, Collaboration, focuses on teachers' coordination and cooperation with others regarding the use of the innovation. In the final stage, Refocusing, teachers start to explore more universal benefits from the innovation. The seven stages are further categorized into three dimensions—self-based concerns (Awareness, Information, Personal), task-based concern (Management), and impact-based concerns (Consequence, Collaboration, Refocusing). Ideally, teachers should progress from the low-level self-based concerns to the high-level impact-based concerns toward an innovation as they become more knowledgeable about and experienced with the innovation. Theoretically, at the early period of an innovation's adoption, when learners know little about the innovation,

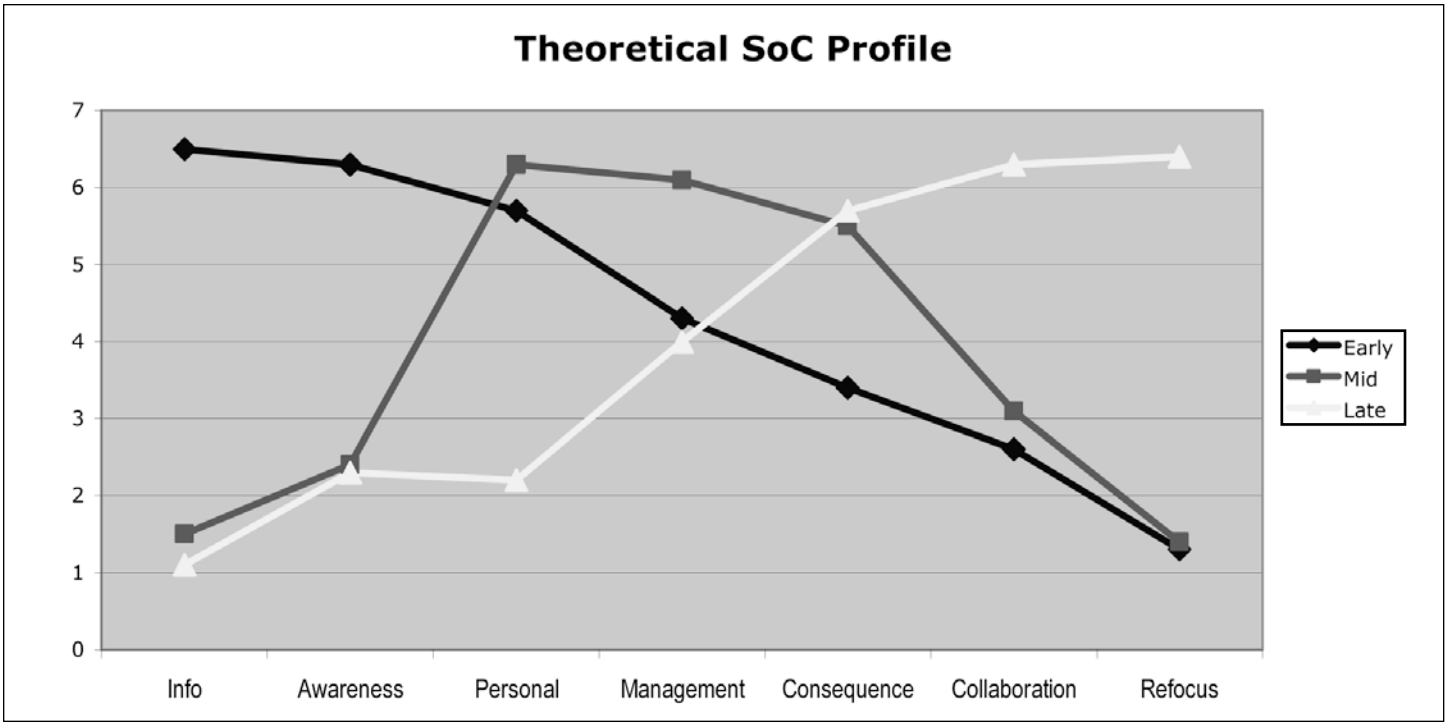


*Figure 1: Example of Theoretical SoC Profile Shift*

their concern levels should start very high at the self-based stages and then decrease gradually to the task-based and impact-based stages (Figure 1). At the midpoint of the innovation's adoption, when learners are getting to know more and more about it, a concerns profile changes to a "bell curve." Toward the end of the innovation's adoption, when the learners have had adequate experience with it, their concern levels should be very low at the self-based stages but increase dramatically at the impact stages (Hall, George, and Rutherford, 1977).

The original version of the questionnaire uses the word *innovation* in all items. In this study, the innovation was the technology-enhanced instructional strategies that were the focus of the professional development courses, so the word *innovation* was replaced with course-specific word(s) according to the content of each course, as intended by the instrument creators (Hall et al.). For example, an original item in one course, "I am not concerned about this innovation," became "I am not concerned about the use of graphic organizers."

The SoC questionnaire consists of 35 items rated along an 8-point scale (0–7), with 0 indicating a very low concern on the respective stage and 7 a very high concern. The seven concern stages are represented by five questions each, which are randomly scattered within the questionnaire. The internal consistency coefficient of reliability for the seven SoC constructs ranges from 0.64 to 0.83, and the test-retest reliability ranges from 0.65 to 0.86 (Hall et al., 1977).

In addition, relevant demographic questions were included in the pretreatment survey.

***Interview protocol.*** To triangulate the quantitative data from the surveys, qualitative data were collected from a semi-structured interview protocol that the authors constructed specifically for this evaluation. The protocol is a comprehensive instrument covering various aspects of learning and using instructional technology. It contains seven categories and 30 questions. Two university professors with expertise in research methodology reviewed the interview protocol, which was then pilot tested with 10 course participants in the first grant year (2003). The authors revised it according to the experts' comments and the results of the pilot tests.

## Procedure

***Stages of Concern.*** We delivered the SoC questionnaire online via Inquisite survey software. All course participants were required to complete the SoC presurvey and postsurvey at the beginning and end of each course, and the course facilitators monitored these surveys via the course management system. The program evaluators (the authors) e-mailed the follow-up survey URL to all participants 3–6 months after they completed the course to allow sufficient time for them to implement the newly learned instructional technologies and strategies. Two reminder e-mails were sent to nonrespondents at one-week intervals. A total of 962 participants completed the pre- and postsurveys, but, due to various reasons (moving, e-mail failure, disregard, technical problems, etc.), 456 participants (47%) responded to the follow-up survey. After data cleaning, 377 matched valid data entries remained. Data confidentiality was guaranteed.

***Interviews.*** The authors randomly selected potential interviewees from the course participants and contacted them via e-mail to request their voluntary participation in the interviews. We interviewed 51 participants, among whom an overwhelming majority was female (N=47/92%). A large proportion of the interviewees were PK–6 teachers (N=22/43%). The number of middle school teachers was similar to the number of high school teachers (N=14/27% and N=12/24% respectively), and the remaining three interviewees (6%) were either school administrators or technology resource personnel. In terms of age, 17 interviewees (33%) were more than 50 years old, 16 (31%) were between 41 and 50, 13 (26%) were between 31 and 40, 5 (10%) were between 25 and 30, and none was younger than 25. The interviews took place at about the same time the participants completed the follow-up survey. The distribution of gender and age groups of those interviewed is similar to the entire sample.

All interviews lasted approximately 30–40 minutes and were conducted face to face at a location that the interviewees selected. The interviewers (the authors) used the semistructured interview protocol but probed respondents for further information when appropriate. We assured the participants that their responses would be confidential and that only the authors would see them. We audiotaped and transcribed all interviews and applied member checks during the interviews for clarification, explanation, and confirmation whenever necessary.

### *Data Analysis*

***Stages of Concern.*** To measure changes in participants' concern levels toward instructional technology, one-way repeated measures analysis of variance (ANOVA) tests were conducted. The within-subject factor was the survey administration time with three levels (pre-, post-, and follow-up survey), and the dependent variables were the seven concern stages (Awareness, Information, Personal, Management, Consequence, Collaboration, and Refocusing).

To further assess whether these courses had any differential effects on participants' stages of concern due to participants' age, gender, and school level taught (independent variables), participants were stratified into five age groups (younger than 25, 25–30, 31–40, 41–50, older than 50), and three school-level groups (elementary, middle, high). We analyzed participants' responses on the seven concern stages from the postsurvey measures (dependent variables) using ANCOVA and adjusted for differences on the corresponding concern stages from the presurvey measures (covariates).

***Interviews.*** We analyzed the transcripts from the audiotapes recorded during the interviews using a qualitative approach to search for categories, themes, and patterns emerging from the data (Patton, 2001). The qualitative data in this study served as a complementary data source so that we could help explain the quantitative results and better understand the courses' impacts on participants' technology integration efforts. Using the qualitative data analysis software NVivo, one author first coded the transcripts, and the other author reviewed and revised them. Whenever a discrepancy occurred, we discussed the issue and achieved an agreement.

## Results

### *Quantitative Results*

The first research question examined the course's impact on participants' stages of concern toward instructional technology integration. Repeated measures ANOVA tests were performed on each of the seven SoC domains (Awareness, Information, Personal, Management, Consequence, Collaboration, and Refocusing—dependent variables) to identify any changes in participants' concern levels from the presurvey to the postsurvey to the follow-up survey (independent variables). The overall ANOVAs were significant on all seven dependent measures: Awareness, Wilks' = .89, $F$ (2, 375) = 21.91, $p$ <.01, η2 =.11; Information, Wilks' = .64, $F$ (2, 375) = 104.74, $p$ <.01, η2 =.36; Personal, Wilks' = .77, $F$ (2, 375) = 56.30, $p$ <.01, η2 =.23; Management, Wilks' = .86, F (2, 375) = 30.74, $p$ <.01, η2 =.14; Consequence, Wilks' = .96, F (2, 375) = 8.51, $p$ <.01, η2 = .04; Collaboration, Wilks' = .94, $F$ (2, 375) = 12.33, $p$ <.01, η2 =.06; and Refocusing, Wilks' = .96, $F$ (2, 375) = 7.65, $p$ <.01, η2 =.04 (Table 1). Follow-up pairwise comparisons were conducted on each dependent variable to identify significant mean differences between any two survey administration points. The paired-sample $t$-test comparisons revealed that there were significant mean differences between the presurvey and postsurvey on all dependent measures except Consequence. Significant differences were found between the presurvey and follow-up survey on four of the seven dependent measures: Information, Personal, Management, and Consequence. There were also significant differences between the postsurvey and follow-up survey on five dependent measures: Awareness, Management, Consequence, Collaboration, and Refocusing (Table 2). The descriptive statistics presented in Table 3 and Figure 2 showed that participants' concern patterns were quite similar at each of the three survey administration points. The lowest type of concern was Awareness, followed by Management. The three impact-based concerns were consistently high. The general trend of individual concerns was for participants' concern levels to drop for the self- and task-based con-

**Table 1: ANOVA Results of Participants' States of Concern on Pre-/Post-/Follow-up Measures**

| DV | Wilks' Λ | *df* | *F* | *p* | η 2 |
|---|---|---|---|---|---|
| Awareness | .89 | 2 | 21.91 | .00 | .11 |
| Information | .64 | 2 | 104.74 | .00 | .36 |
| Personal | .77 | 2 | 56.30 | .00 | .23 |
| Management | .86 | 2 | 30.74 | .00 | .14 |
| Consequence | .96 | 2 | 8.51 | .00 | .04 |
| Collaboration | .94 | 2 | 12.33 | .00 | .06 |
| Refocusing | .96 | 2 | 7.65 | .00 | .04 |

*Note: p < .001*

**Table 2: The Paired-sample *t*-Test Comparisons on Participants' Stages of Concern**

| Dependent Variable | | Mean Difference | SE | *df* | *t* | *p* |
|---|---|---|---|---|---|---|
| Awareness | Pre vs. Post | 1.64 | .30 | 376 | 5.44 | .00* |
| | Pre vs. Follow-up | -.06 | .33 | 376 | .18 | .86 |
| | Post vs. Follow-up | -1.70 | .30 | 376 | 5.68 | .00* |
| Information | Pre vs. Post | 4.58 | .38 | 376 | 12.03 | .00* |
| | Pre vs. Follow-up | 4.97 | .39 | 376 | 12.81 | .00* |
| | Post vs. Follow-up | .39 | .40 | 376 | .99 | .32 |
| Personal | Pre vs. Post | 4.22 | .44 | 376 | 9.55 | .00* |
| | Pre vs. Follow-up | 4.42 | .47 | 376 | 9.33 | .00* |
| | Post vs. Follow-up | .21 | .42 | 376 | .49 | .62 |
| Management | Pre vs. Post | 3.33 | .43 | 376 | 7.83 | .00* |
| | Pre vs. Follow-up | 1.65 | .43 | 376 | 3.83 | .00* |
| | Post vs. Follow-up | -1.68 | .41 | 376 | 4.15 | .00* |
| Consequence | Pre vs. Post | .43 | .33 | 376 | 1.29 | .20 |
| | Pre vs. Follow-up | 1.45 | .36 | 376 | 4.01 | .00* |
| | Post vs. Follow-up | 1.02 | .34 | 376 | 3.01 | .00* |
| Collaboration | Pre vs. Post | -1.31 | .31 | 376 | 4.20 | .00* |
| | Pre vs. Follow-up | .16 | .38 | 376 | .42 | .67 |
| | Post vs. Follow-up | 1.47 | .36 | 376 | 4.06 | .00* |
| Refocusing | Pre vs. Post | -1.07 | .30 | 376 | 3.57 | .00* |
| | Pre vs. Follow-up | -.14 | .35 | 376 | .41 | .68 |
| | Post vs. Follow-up | .93 | .33 | 376 | 2.83 | .01* |

*Note: *p ≤ .01*

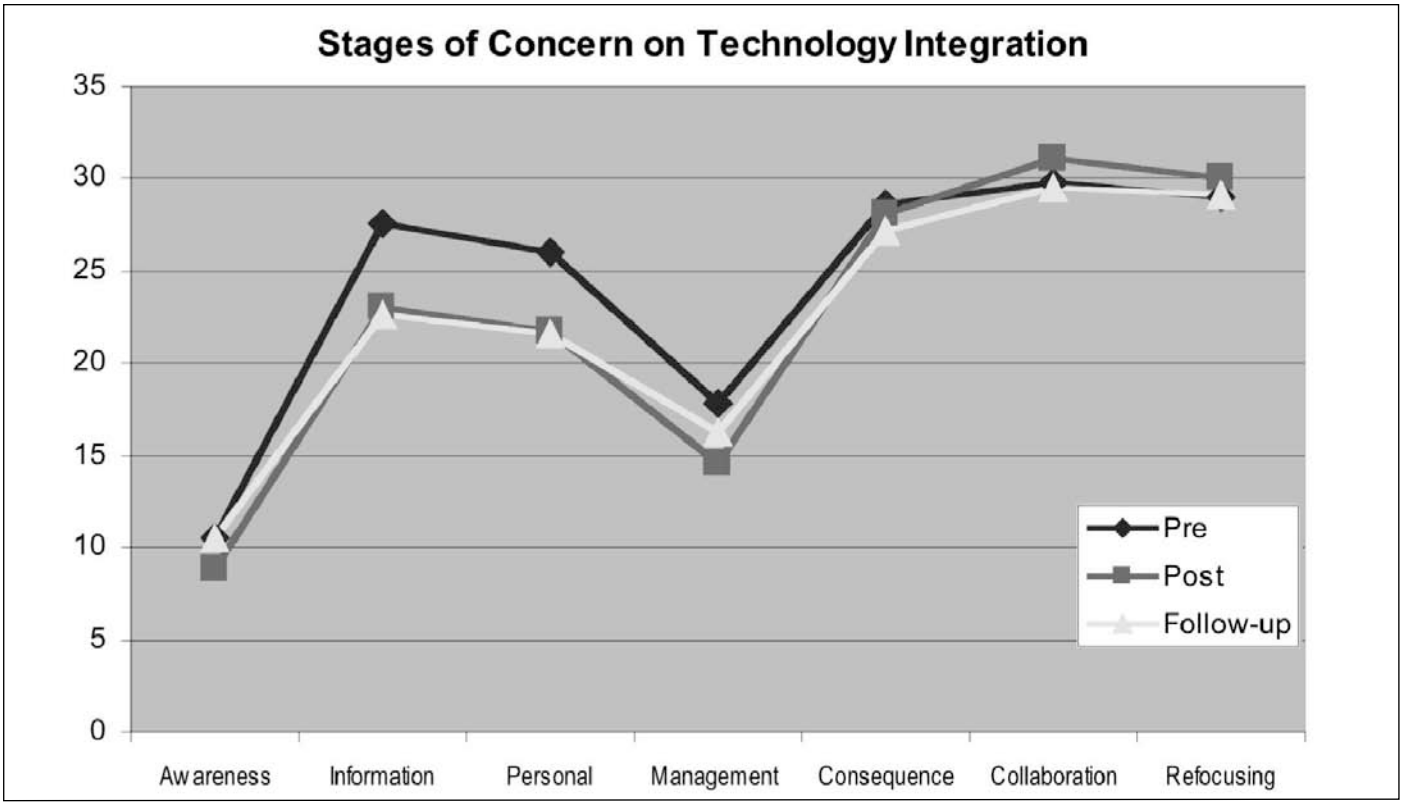


*Figure 2: Participants' Stages of Concern by Survey Time*

**Table 3: Descriptive Statistics of Participants' Stages of Concern on Pre/Post/Follow-up Measures**

| | Presurvey | | Postsurvey | | Follow-up | |
|---|---|---|---|---|---|---|
| DV | M | SD | M | SD | M | SD |
| Awareness | 10.51 | 5.69 | 8.87 | 5.43 | 10.57 | 5.61 |
| Information | 27.64 | 5.63 | 23.06 | 6.62 | 22.67 | 6.70 |
| Personal | 25.96 | 7.41 | 21.75 | 8.54 | 21.54 | 8.81 |
| Management | 17.89 | 7.55 | 14.56 | 7.35 | 16.24 | 7.82 |
| Consequence | 28.59 | 6.15 | 28.16 | 6.73 | 27.14 | 6.74 |
| Collaboration | 29.75 | 6.55 | 31.07 | 7.24 | 29.59 | 7.74 |
| Refocusing | 28.97 | 5.75 | 30.04 | 5.68 | 29.11 | 6.25 |

*Note: Total score for each category is 35.*

**Table 4: ANCOVA Results on Participants' Stages of Concern as a Function of Age**

| Source | *df* | MS | *F* | *p* | η 2 |
|---|---|---|---|---|---|
| Post-Awareness | 4 | 137.60 | 6.18 | .00* | .06 |
| Post-Information | 4 | 108.59 | 2.75 | .03* | .03 |
| Post-Personal | 4 | 149.04 | 2.54 | .04* | .03 |
| Post-Management | 4 | 124.76 | 2.75 | .03* | .03 |
| Post-Consequence | 4 | 87.26 | 2.59 | .04* | .03 |
| Post-Collaboration | 4 | 38.07 | 1.17 | .33 | .01 |
| Post-Refocusing | 4 | 58.14 | 2.37 | .05* | .03 |

*Note: * p < .05*

cerns from the presurvey to the post- and follow-up surveys, with the greatest decrease on Information and Personal. For the impact-based concerns, the participants' concern levels at the three survey times were quite similar, although the postsurvey concern levels were higher than the other two.

The second research question investigated whether the courses' effects on participants' concerns toward instructional technology integration differed according to participant age. Using participants' presurvey scores for the seven stages of concern as covariates and Age as an independent variable, we performed ANCOVAs on participants' postsurvey scores for each of the seven stages of concern (dependent variables). Significant differences were found on all dependent measures except Collaboration: $F$ (4, 369) = 6.18, $p$ < .01, $\eta^2$ = .06 on Awareness; $F$ (4, 369) = 2.75, $p$ < .05, $\eta^2$ = .03 on Information; $F$ (4, 369) = 2.54, $p$ < .05, $\eta^2$ = .03 on Personal; $F$ (4, 369) = 2.75, $p$ < .05, $\eta^2$ = .03 on Management; F (4, 369) = 2.59, $p$ < .05, $\eta^2$ = .03 on Consequence; and $F$ (4, 369) = 2.37, $p$ = .05, $\eta^2$ = .03 on Refocusing (Table 4).

Post hoc pairwise comparisons were conducted to test for group differences on the six significant dependent measures. We observed the same concern pattern in these ANCOVAs that we did in the ANOVA for the pre-/post-/follow-up surveys: Participants of all age groups had higher concern levels at the impact-based stages than those at the self- and task-based stages. The descriptive statistics detailed in Table 5 (page 50) and Figure 3 (page 51) illustrated that the youngest group (younger than 25) exhibited significantly higher self- and task-based concerns than other age groups. (For the sake of simplicity and clarity, only comparisons with significant mean differences are included in the table.) The second age group (25–30) had the lowest concerns at virtually all the stages. The remaining age groups (31–40, 41–50, and older than 50) had similar concern levels at each stage. Specifically, at the Awareness stage, the youngest group had significantly higher concerns than all the other age groups, but no significant differences were found across any other age groups on this stage. At the Information stage, the youngest group also had the highest concern (M=26.48), followed by the third age

**Table 5: Post Hoc Pairwise Comparisons on Participants' Stages of Concern by Age**

| Source | | | Adjusted Mean | *F* | *p* |
|---|---|---|---|---|---|
| Awareness | < 25 vs. Adj. M=14.55 | 25–30 | 8.60 | 18.38 | .00* |
| | | 31–40 | 9.22 | 16.13 | .00* |
| | | 41–50 | 8.25 | 23.66 | .00* |
| | | > 50 | 8.60 | 20.86 | .00* |
| Information | < 25 vs. Adj. M=26.48 | 25–30 | 21.70 | 6.74 | .01* |
| | | 41–50 | 22.33 | 5.78 | .00* |
| | 25 – 30 vs. Adj. M=21.70 | 31–40 | 24.14 | 4.81 | .03* |
| | | 41–50 | 22.33 | 4.02 | .00* |
| | 31 – 40 vs. Adj. M=24.14 | 41–50 | 22.33 | 4.02 | .05* |
| Personal | < 25 vs. Adj. M=24.95 | 25–30 | 19.66 | 5.47 | .02* |
| | 25 – 30 vs. Adj. M=19.66 | 31–40 | 22.90 | 5.59 | .02* |
| | | > 50 | 22.32 | 4.16 | .04* |
| Management | < 25 vs. Adj. M=18.53 | 25–30 | 12.77 | 8.42 | .00* |
| | | 41–50 | 13.98 | 6.06 | .01* |
| | 25 – 30 vs. Adj. M=12.77 | 31–40 | 15.12 | 3.87 | .05* |
| | | > 50 | 15.10 | 4.19 | .04* |
| Consequence | 25 – 30 vs. Adj. M=25.87 | 31–40 | 28.41 | 6.07 | .01* |
| | | 41–50 | 28.32 | 6.39 | .01* |
| | | > 50 | 28.95 | 9.89 | .00* |
| Refocusing | 25 – 30 vs. Adj. M=28.17 | 31–40 | 30.50 | 7.03 | .01* |
| | | 41–50 | 30.25 | 6.34 | .01* |
| | | > 50 | 30.47 | 7.58 | .01* |

*Note: * p < .05*

group (31–40; M=24.14). The second age group (25–30) had the lowest concern (M=21.70), and the fourth age group (41–50) was next to the lowest (M=22.04). The fifth age group (older than 50) fell in the middle (M=23.08), which was not significantly different from other groups at this stage. At the Personal stage, the highest concern was again found in the youngest group (M=24.95), and the lowest concern was in the second group (25–30; M=19.66). This was significantly different from all the other groups except the fourth group (41–50; M=20.93), and the same pattern was observed at the Management stage. At the Consequence stage, the second group (25–30) still had the lowest concern, and all the other groups were quite similar. At the Collaboration stage, no significant differences were found between any groups; this was the stage at which all the age groups had the most intense concern. Finally, at the Refocusing stage, much like at Consequence, the lowest concern group was the second group (25–30), followed by the youngest group, and the rest of three groups were almost identical.

To answer the third research question, "Does gender play a role in participants' stages of concern toward instructional technology integration?" we performed one-way ANCOVA to assess differences in adjusted postsurvey mean scores between male participants and female participants on each of the seven concern stages (dependent variables) using participants' presurvey scores on the corresponding stages of concern as covariates and Gender as an independent variable. Significant differences were found on two dependent measures—Personal ($F$ (1, 374) = 9.98, $p$ < .01, η2 = .03) and Management ($F$ (1, 374) = 5.30, $p$ < .05, η2 = .02) (Table 6). The descriptive statistics depicted in Table 7 and Figure 4 (page 52) showed that on both Personal and Management, the male group had higher concerns than the female group: On Personal, the mean of the posttest scores adjusted for initial differences was 24.68 (out of 35) for the male group, whereas the adjusted mean for the female group was 21.22. On Management, the mean of the posttest scores adjusted for initial differences was 16.44 for the male group, whereas the adjusted mean for the female group was 14.22.

Finally, to explore whether participants' stages of concern toward technology integration varied based on the school levels at which they teach, we conducted one-way ANCOVA on participants' postsurvey scores for each of the seven stages of concern (dependent variables), with participants' corresponding presurvey scores at each stage as covariates, and school level (elementary, middle, high) as an independent variable. The ANCOVAs failed to yield any significant difference across school levels on any stages of concern except Information. However, the small

**Table 6: ANCOVA Results on Participants' Stages of Concern as a Function of Gender**

| Source | *df* | MS | *F* | *p* | η 2 |
|---|---|---|---|---|---|
| Post-Awareness | 1 | 2.26 | .10 | .76 | .00 |
| Post-Information | 1 | 121.97 | 3.03 | .08 | .01 |
| Post-Personal | 1 | 581.49 | 9.98 | .00* | .03 |
| Post-Management | 1 | 241.61 | 5.30 | .02* | .02 |
| Post-Consequence | 1 | .13 | .01 | .95 | .00 |
| Post-Collaboration | 1 | 1.89 | .06 | .81 | .00 |
| Post-Refocusing | 1 | 5.53 | .22 | .64 | .00 |

***Note: * p < .05***

**Table 7: Descriptive Statistics for Participants' Stages of Concern by Gender**

| Source | | Unadjusted Mean | SD | Adjusted Mean | SE |
|---|---|---|---|---|---|
| Awareness | Male | 8.83 | 4.76 | 9.05 | 7.79 |
| | Female | 8.88 | 5.54 | 8.84 | 8.30 |
| Information | Male | 24.74 | 6.52 | 24.40 | .83 |
| | Female | 22.76 | 6.60 | 22.82 | .36 |
| Personal | Male | 25.60 | 8.66 | 24.68* | 1.01 |
| | Female | 21.04 | 8.34 | 21.22* | .43 |
| Management | Male | 16.36 | 7.62 | 16.44* | .87 |
| | Female | 14.23 | 7.27 | 14.22* | .38 |
| Consequence | Male | 28.93 | 7.31 | 28.12 | .77 |
| | Female | 28.02 | 6.62 | 28.16 | .34 |
| Collaboration | Male | 31.81 | 7.04 | 31.23 | .75 |
| | Female | 30.93 | 7.27 | 31.04 | .32 |
| Refocusing | Male | 30.16 | 6.41 | 29.75 | .66 |
| | Female | 30.02 | 5.55 | 30.09 | .28 |

*Note: * Significant mean difference was found on the dependent measures between groups.*

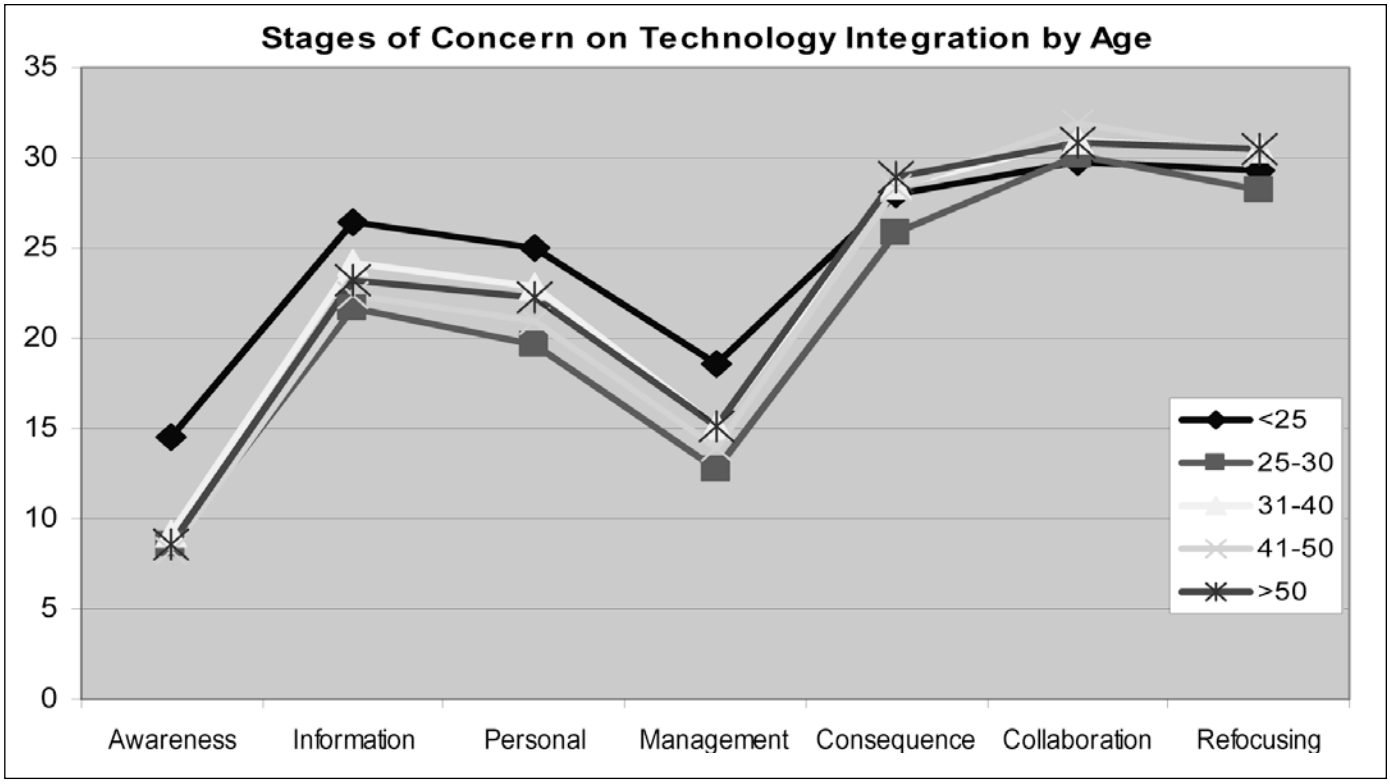


*Figure 3: Participants' Stages of Concern on Technology Integration by Age*

effect size (.02) suggested that this difference might not have any practical significance. Therefore, we did not further explore this question.

### *Qualitative Results*

To triangulate the data source and have a better and more comprehensive understanding of teachers' concerns about learning and using instructional technology, we conducted interviews with a sample of course participants a few months after they completed the course. We analyzed interview transcripts using an inductive qualitative approach, and the results were largely consistent with the quantitative findings. Below is a summary of major findings from the interviews.

***Positive responses.*** All interviewees expressed that they had learned many new computer and Internet skills and had learned about online resources and instructional strategies, which made them more capable of technology integration. Many interviewees acknowledged that the NCLB-EETT–funded courses expanded their knowledge bases in technology and empowered them to use them in more sophisticated, efficient, effective, and meaningful ways. One teacher said that she was now the most knowledgeable person in technology in her school and that she could help other teachers with many computer and Internet issues. Another teacher revealed her personal changes as a result of taking the course: "Before I took the course, I was not confident in my computer skills. I often worried that I might destroy the system or damage the computer because of inappropriate use. I was also concerned whether my documents were traceable or in good format, etc. Now, as I know more about computers, I've become more interested in it and use it more frequently." Another teacher noted a similar perception: "Our students are a computer generation. Teachers often find themselves falling behind their students. This course really helped teachers to meet the technology challenges by their students, and thus prepared us to better meet student needs." Many interviewees claimed that, after taking the course, they were able to use more computer applications and access more online resources, and that they had better Internet search techniques, which had been very time consuming for them before. This was consistent with the quantitative results that the courses helped lower participants' self-based concerns by empowering them with technology skills and resources, especially at the Information and Personal stages.

In terms of the resultant impact of the course on participants' students, many interviewees reported that their students became more interested in and skillful with technology as a result of becoming more capable technology consumers. A considerable number of interviewees shared the notion that technology expands the traditional teaching materials and conventional instructional procedures, allowing teachers to have more alternative approaches, which make the teaching/learning process more productive and appealing to students. They repeatedly articulated that whenever technology was incorporated into instruction, students would become more motivated, enthusiastic, focused, attentive, and interactive in the learning process. Comments included: "Because kids are fascinated in and skillful with the computer, using technology in teaching provides kids opportunities to learn and do what they enjoy and are good at, and this makes them learn more actively and be more responsible for their own learning;" "We used technology in collaborative education, where regular kids and special kids learn together. Obviously, they are more actively involved in learning activities and have deeper understanding of what is covered;" "The technology tools and the instructional strategies I learned from the course enable me to ask high-quality questions that help develop students' critical-thinking and problem-solving abilities." These statements echoed the quantitative results that teachers cared about the impact of their learning and using technology on their students' learning, which explains why their concern at the Consequence stage started and remained high.

Most interviewees also believed that their learning experiences in the course enabled them to effectively incorporate technology into their instructional practices, which encouraged their colleagues to use more technology. One elementary school teacher created an e-story program during the course that helped her get a grant. Her program is now used in the whole school district. Another teacher produced a research project with Inspiration (a graphic organization software program), which

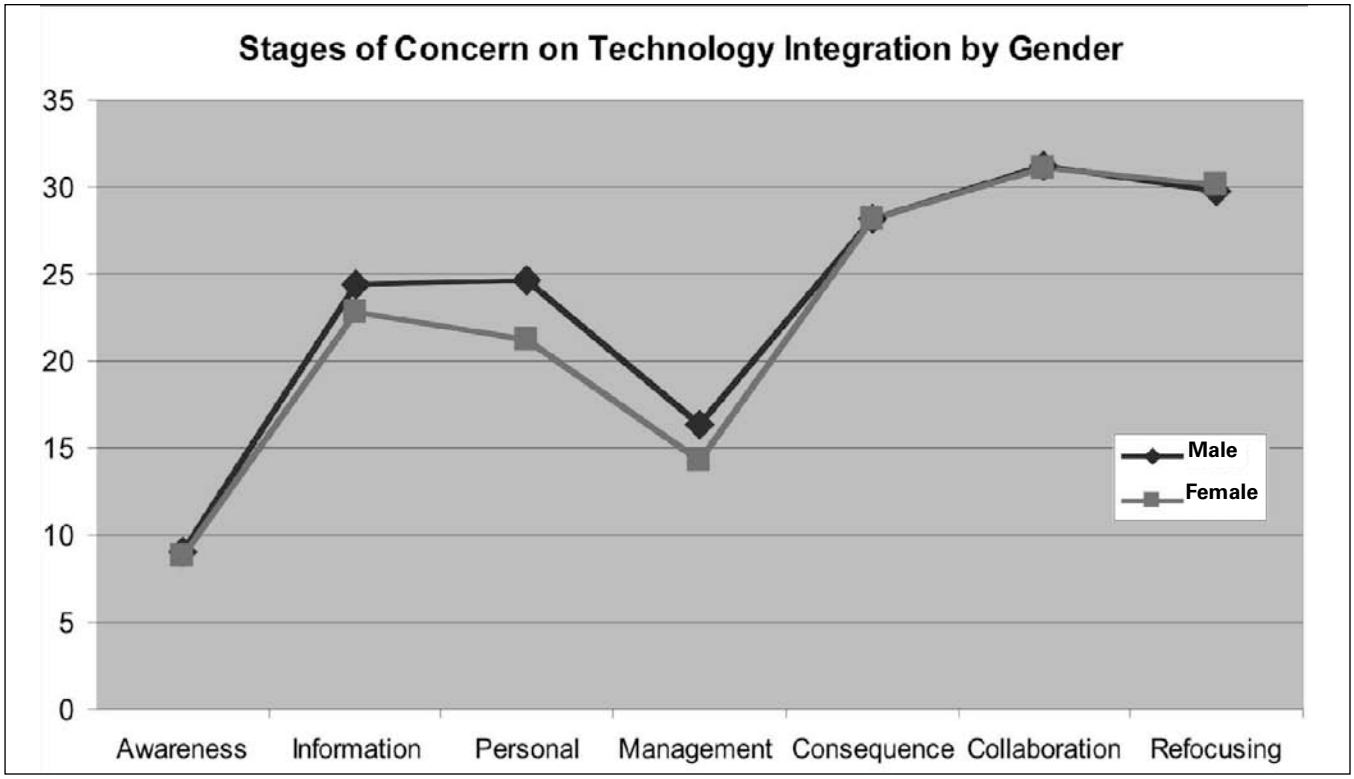


*Figure 4: Teachers' Stages of Concern Toward Technology Integration by Gender*

brought in a grant for implementation. Under her influence, many teachers in her school now are able to use Inspiration to develop lessons and conduct projects. Many interviewees opined that they would like to take follow-up courses regularly to help them keep up with new technologies and help them resolve new challenges when they try to implement more and different technologies. These cases illustrated that, after obtaining necessary technology information and skills, teachers' attention would naturally shift to explore new and more sophisticated ways of using technology to maximize the benefits of technology integration for their students as well as for their fellow teachers. This may be an indicator that teachers' concern levels were comparatively high at the Collaboration and Refocusing stages.

***Negative responses.*** To the question "What concerns do you have in technology integration?" many interviewees' responses centered on the accessibility to technology resources: They either did not have sufficient hardware and/or software, or the equipment was too old, slow, and incompatible with new educational software and networks. Typical comments included: "The only concern I have is the availability of technology so that the students and teachers can use the resources as often as needed and possible;" "We have no printers, no video cameras, no laptops, and no necessary software;" "Our school doesn't have the resources to facilitate the use of some technologies. For example, I burned a CD during the workshop [courses] with many wonderful programs, but I just cannot use them in the building."

Time management was another big concern for teachers. Most interviewees expressed that they loved to use technology, but to design a technology-integrated lesson took significantly more time because they had to search for appropriate computer programs and software, schedule the use of labs or devices, assemble/set up equipment, and guide students in the mechanics of operating the technology. In addition, some interviewees expressed the opinion that the pressure to pass SOL tests made spending additional time exploring and developing technology-based lessons in lieu of their old "tried and true" lessons even more difficult.

Several teachers were also concerned about the availability and efficiency of technical support staff. They complained that hardware and software problems could not be resolved in a timely manner, which caused interruption to their normal instruction.

Finally, many interviewees expressed their concern about students' use of technology. They shared the belief that guiding students to use technology appropriately and effectively must be taken into consideration when exposing students to technology. Typical comments were: "Sometimes I'm worried that students are too fascinated with the format or effects of technical tools and ignore what should be the real issues of interest;" "There are too many inappropriate sites and materials for kids…. Maybe teachers should create 'pathfinders' to help students locate credible, helpful, and appropriate materials;" "Kids nowadays rely too much on computers and the Internet. They are less apt to go to a library or read a journal, and less apt to explore alternative sources of information other than what is found on the Internet."

## Discussion

### *Whole-Group Concerns Profile*

The first research question was designed to profile the grant participants' concerns as a group. The results are consistent with the theoretical expectation that the self- and task-based concerns would be lowered as a result of participating in the program (Figure 1). The Awareness concern was very low at the pretest point. This makes sense because the participants had volunteered to enroll in the courses, which meant they were already aware of the course content and the lack of change is therefore unsurprising. The reduction of Information and Personal concerns at the postsurvey point and the maintenance of those changes to the follow-up point indicated that the participants were able to learn and to project how they would accommodate their new knowledge and skills in the classroom. This is consistent with the changes in the task-based Management concern, but it should be noted that the Management concern bounced back to the original levels at the follow-up point. We believe that the professional

development courses clearly delineated ways to infuse the new content into the classroom. The teachers left with high hopes that implementation was attainable, but the reality was that their efforts may have been met with environmental barriers (e.g., inadequate equipment or inefficient technical support). However, the management concerns were relatively low and should not be interpreted as an indicator of substandard technology infrastructure and support in schools, a conclusion that is supported by two separate studies of the state of instructional technology and implementation in schools in the same geographic area (Lu & Overbaugh, 2008; Lu & Overbaugh, in press).

The high impact-based concerns—Consequence, Collaboration, and Refocusing—at the presurvey point indicate that these teachers were already cognizant of the effects of technology-based/enhanced instruction in the classroom, are willing to work with others, and have the inclination to look for new ways to use technologies with which they are already familiar. These characteristics are highly desirable. Although change did occur at these stages at different survey times, the changes were not large, which makes sense because the sample started at high levels. More specifically, Consequence was the only stage whose level of concern dropped from pretest to posttest and again at the follow-up test, which means that the participants as a group believed that the new technology and strategies would have positive effects on their students and that classroom implementation furthered their confidence as they met with success. The remaining two stages—Collaboration and Refocusing—rose significantly from pretest to posttest but returned to pretest levels at the follow-up point. A reasonable explanation for this is that, even though these concerns were high to start with, the courses raised the participants' concerns about working with others and about repurposing the technology and strategies, but after implementation, the expectations returned to their previous high point. This does not have any negative implication, as the favorable impact concerns started high and essentially remained high.

One caution, though, is that the sample in this study volunteered to participate in the grant-funded courses, so these concerns profiles may not represent the teacher population as a whole, which should be considered a limitation of the study.

The remaining research questions were intended to identify any differential concern levels within the sample. Accordingly, the sample was subsequently blocked according to age, gender, and school level.

### *Stages of Concern and Age*

The investigation of age groups resulted in some interesting findings. Although most of the effect sizes were small, the data showed some interesting trends. The first was that the youngest (younger than 25) group of teachers clearly displayed significantly higher levels on the self- and task-based concerns (Awareness, Information, Personal, and Management), whereas their concern levels at the impact-based stages (Consequence, Collaboration, and Refocusing) were similar to the other age groups. This suggests that because these teachers are new to the classroom, they are still learning and acclimating to their jobs and thus retain high levels of concern regarding what is expected of them in terms of instructional technology, and how they can learn about it and successfully integrate it into their classroom. This reasoning is supported by their high concerns at the impact-based stages, which is shared by all age groups, indicating that these same young teachers are also able to focus on the outcomes of technology-enhanced teaching and learning and are willing to work with others to maximize benefits.

The second age group (25–30) showed just the opposite concern pattern. These teachers exhibited the lowest concern levels across all seven stages, reaching significance on all but Collaboration. A common notion is that the first three years of teaching are the most difficult (as is supported by the concerns profile of the youngest group), after which teachers will become more comfortable with the job. The results seem to suggest that this is the case with instructional technology. A plausible explanation is that after a few years of teaching experience, teachers in the age range of 25–30 have had time to become comfortable with the use of instructional technology. They may also believe that the technology knowledge and skills they learned in college remain up to date and therefore exhibit lower concerns than their peers.

The remaining age groups show a similar concerns profile that largely fits between the youngest group and the second youngest group (Figure 3). This finding suggests that most teachers begin their teaching careers with elevated levels of concern at most stages toward instructional technology. They then become more comfortable with it for a period of time, after which their concerns bounce back to a happy medium that seems to sustain over time. The fact that all age groups exhibited high impact-based concerns is very good.

### *Stages of Concern and Gender*

Males were found to have higher concerns at the Personal and Management stages than female teachers. This suggests that male teachers are more concerned than their female counterparts about how instructional technology would affect them personally and how they could manage the infusion of technology into their classrooms. Considering the small effect sizes, this difference may have occurred by chance, but it could be a comparison to continue to look into.

### *Stages of Concern and School Level*

No notable differences were found across elementary, middle, and high school teachers on their stages of concern, which shows that the overall climate for the infusion of instructional technology is consistent across school levels. This is an important finding as there is often a perception that upper-level schools benefit from more, and more complex, technologies.

## Conclusions and Recommendations

### *Viability of the Stages of Concern Instrument*

The concerns profile exhibited by the participants in this study is not congruent with the theoretical profile (Figure 1). The sample in this study exhibited lower concerns at the Awareness and Management stages and higher concern levels at all impact-based stages at the three data collection points (Figure 2). One might posit that these results suggest validity problems with the SoC instrument, but we agree with George, Hall, and Steigelbauer (2006) that this is not the case. As discussed above, the concerns profile of this sample is logical, tenable, and supported by teacher comments in the interviews. Furthermore, other researchers have found similar concerns profiles. Giordano (2007) reported similar results in a study on classroom Internet usage with a sample of 88 teachers from 44 schools who were nominated by their administrators to participate in an 8-week Internet training course, as did Liu and Szabo (2008) with inservice teachers enrolled in a graduate course. We therefore believe that the profile is not only accurate, but that the instrument remains a valid tool for assessing teachers' attitudes toward the innovation of technology-enhanced teaching and learning.

### *Target Audience*

The results show that the professional development courses were beneficial to all groups, but the youngest teachers maintained significantly higher concerns at the self- and task-based stages over time. This suggests that they may stand to benefit more than others from continued professional development opportunities. Therefore, future broad-stroke teacher professional development efforts might benefit from extra efforts to recruit the youngest teachers.

### *Focus of Professional Development Instruction*

The largest changes occurred at the Information and Personal stages, which supports the common notion that professional development should be frequent and ongoing. These results suggest that professional development can focus mostly on addressing teachers' self-based concerns by providing information about technology-enhanced/based teaching and learning strategies and how they can incorporate those strategies into their existing curricula. Conversely, professional development efforts may not need to be overly concerned about convincing teachers that the new strategies will help their students learn, as they already know that. Efforts may also not need to emphasize collaboration with others because teachers are already working with others and figuring out different ways to use what they already have and know.

### *Variety of Professional Development Content*

The professional development examined in this study comprises a variety of courses and two course formats. The online courses were selected from a wide variety of PBS Teacherline courses (http://www.pbs.org/teacherline/), which are available to anyone, anywhere. The CII consortia made selections based on the needs of their member schools and, to further meet teachers' needs, hired local facilitators because their contextual understanding would enable them to shape the courses based on local school conditions. In addition, the CII consortium created their own one-week summer immersion workshops because of demand from participant schools. Our purpose is not to recommend or endorse any particular product but to recommend that a variety of professional development content be offered in the aforementioned ongoing fashion so that teachers have plenty of opportunities to enhance their teaching skills. Furthermore, because teachers are already convinced of the usefulness of classroom technologies and their related instructional strategies, professional development programs need not be overly concerned with motivation levels and can provide more informational and operational knowledge-type workshops.

### *Match Classroom Environment and Professional Development*

The changes in the task-based Management level reflect environmental barriers to technology implementation. Although the concerns at this stage were reasonably low, they remain a factor that should and can be addressed by professional development efforts. Clearly, well-designed professional development courses and workshops should provide instruction that incorporates instructional conditions and elements congruent with those already available in the classroom. Those offering professional development in their own schools or school districts or who use local facilitators for adaptation can accomplish this easily, but it is virtually impossible for broad-spectrum offerings such as the PBS Teacherline. Because effective technology implementation "depends upon identifying and establishing the essential conditions to support optimal implementation" (Strudler, 2003, p. 73), a final recommendation is that a description of the essential implementation conditions be part of the professional development description so that teachers or administrators can assess their own teaching environment and enroll in appropriate courses, feeling confident that they will be able put their new knowledge and skills to use in their own classrooms.

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## Appendix A

### *Overall Evaluation Scheme for the NCLB-CII Professional Development Program*

| Evaluation Categories | Evaluation Contents | Evaluation Instruments | Evaluation Time | Evaluation Targets |
|---|---|---|---|---|
| Course evaluation | Standards<br>Course Objectives<br>Course Design<br>Use of Tech | Course evaluation rubric | Postworkshop | All courses |
| | | Interview protocol | Postworkshop | Sample |
| Participant evaluation by ODU | Participant lesson plans | Lesson plan rubric | Postworkshop | All participants' lesson plans |
| | Course effects on participants | Stages of concern (survey) | Pre-/post-/follow-up | All participants |
| | | Self-efficacy (survey) | Pre-/post-/follow-up | All participants |
| | | Learning satisfaction (survey) | Postworkshop | All participants |
| | | Interview protocol | Postworkshop | Sample |
| K–12 technology application evaluation | Course effects on classroom practice | Implementation survey | Postworkshop | All participants |
| | | Class observation | Postworkshop | Sample |
| | | Participant interview protocol | Postworkshop | Sample |