Technology Infusion in a Rural School System: A Case Study from Pennsylvania

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Abstract:

For the past 10 years a rural Pennsylvania school system has worked to develop a high quality educational technology program. In 1997 the district surveyed its faculty and found that there was a low level of technology infusion in the teaching/learning processes. Teachers were also found to be uncomfortable with computers and software applications for both the classroom and also in their lives at home. Between 1997 and 2007 there were a number of changes in the district's curriculum, and a significant infusion of hardware and software was carried out. The district also provided continuous professional development and technical support for its teachers. The survey in 2007 provided data indicating that the situation had changed and technology is now widely utilized. One finding from the 2007 survey was that the home use of computers is a significant predictor of a teacher's embracing educational applications for educational technology. Another significant factor in technology understanding is whether the teacher is an elementary or secondary level educator.

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Introduction

In terms of the number of people living in a rural community, Pennsylvania is one of the most rural states in the Unites States (United States Census Bureau, 2000). There are over three hundred local school systems that the Commonwealth classifies as being a "rural school system" (Pennsylvania Department of Education, 2005). For the purposes of this study, the school system will be referred to as the Granite Rock School District.[i] Granite Rock enrolls about 7,000 students grades K though 12 in four elementary, one intermediate, and two secondary schools. The communities included in the district cover almost 120 square miles, and children are transported by 195 school bus routes. This school system is the focus of this case study.

The district's administration recognized a national trend for teachers to resist the introduction of new technology in their classrooms (Norton, 2008). In 1997 the district initiated a survey of its 400 professional staff to determine the level of computer utilization and the curricular integration of educational technologies into the teaching and learning process. The findings from the data indicated that with the exception of a small cluster of teachers, there was moderate use of technology across the district. Between 1998 and 2007 a new direction for the professional development for all staff members was implemented.

One goal of this in-service initiative was to upgrade the faculties' knowledge base, and the skill levels of teachers for using instructional technology in their classrooms. This goal was met by initiating a series of workshop format in-service programs during after school and over the summer break that focused specifically on basic computer skills and the classroom integration of instructional technology. A

provision of the long term technology plan provided an active "help desk" supported by the district's technologists. This provision answered a need expressed by the district's faculty in 1997.

Literature Review

All too often teachers see new classroom computers as being just "magic" typewriters and limit their use to word processing (Norton, 2008). Bailey and Lumley (1997) reported that staff development is a key component in the integrated instructional use of technology. Professional development can be defined as activities aimed at improving the understanding and developing the necessary skills needed to properly integrate emerging technologies into the curriculum. This planned ongoing approach involves many people at different levels such as the principal, curriculum leaders and technology coordinator. Although many individuals are involved in the skill and knowledge development activities of in-service education, the classroom teachers are the primary participants. The methods by which educators are properly trained to use the technology can be a difficult process to explain because everyone learns at a different pace and at different levels. LeCuyer (1996) stated that school officials must focus efforts on the teacher and provide avenues for technology training, support and curriculum integration.

Specialists in training and development know that the most efficacious method for integrating technology into the educational environment is through curriculum infusion by the teachers. Therefore**,** a smooth integration of technology into the curriculum is best facilitated through high quality in-service education programs (Bailey & Lumley, 1997; Camhi-Geller, 1998). Also, when technology is effectively and efficiently integrated into

educational programs, it should be done across-the-board, in all dimensions and grade levels (Coady, 1997). Time and again, the workshop format with its hands-on components has been proven to be the most effective approach for filling the in-service needs of classroom teachers (Smith, 1998). Although, occasional training seminars may fulfill the district's in-service requirements, it will not affect systemic change; therefore, technology training must be continuous. Also, this type of endeavor must be ongoing and linked to the actual systems in place which are supported by the school district.

Study Design

With the support of the school district's administration a new survey instrument was administered in 2007 to determine the technology proficiency levels of the professional staff and their level of understanding technology. It was adapted from one that was initially designed by the Pennsylvania Department of Education for use with the state's Superintendent's Technology Leadership Academy (STLA). The modifications tailored the questionnaire to the situation within the Granite Rock Schools. Data were collected using this instrument during faculty meetings in March of 2007. Of the total of 423 teachers in the district, data were collected from 410, representing a return rate of 96%. Some of these questionnaires had varying numbers of items that were left blank. The incomplete items resulted in various analyses reported in this study as being based on different numbers of subjects.

Instrumentation

The instrument consisted of 11 sections and 204 individual items. These were combined to create several subscale scores. One of these subscales consisted of four items measuring home use of computer and Internet technology by teachers. The

instrument also had sections for tabulating the teachers' use of: Word Processing, Spreadsheets, e-Mail Skills, Web Browser Skills, Presentation Skills, Network Utilization, Universal "Common" Operations, Database Management Skills, and Computer Operation Skills. There were a total of seven Likert format items that asked the respondents to indicate the degree to which they have integrated educational technology into everyday teaching. The questionnaire items from that section were moderately reliable with a Cronbach alpha coefficient of $\alpha = 0.74$, ($N = 392$). Another seven Likert scale format items asked the teachers about their comfort level using specific educational software supported by the district. The Cronbach alpha coefficient for that section was also at a moderate level ($\alpha = 0.76$; $N = 392$). This section (comfort with software) is a bit garbled as some of the district's software is designed for all teachers while other programs are written specifically for certain grade levels. Thus, having a comfort level with a particular package may reflect its purpose and the teacher's grade level. The nine tabulations of the technology skill areas documented by the teachers were combined into a single measure. This subscale was found to have a high degree of reliability ($\alpha = 0.91$; $N = 398$).

Data Analysis

In order to determine the extent of technology use in the schools, an analysis of responses from both elementary and secondary teachers was conducted. A large proportion (80%) of the data set was composed of elementary teachers (kindergarten through sixth grade). This imbalance reflects the fact that many of the secondary level teachers did not provide complete data on the survey. For this reason the assumption of homogeneity of variance was tested and found not to support the null hypothesis

(Levine's $F = 160.6$, $df = 396$, $p < 0.001$). To meet the requirements of the statistical model, a two group analyses (elementary teachers, secondary teachers) was conducted using the non-parametric Mann-Whitney U test as the primary tool for hypotheses testing. Significant differences favoring the technology skills and knowledge of secondary teachers was noted for the combined nine areas ($z = -3.91$, $df = 327$, $p < 0.001$), and for the use of computers at home ($z = -3.67$, $df = 386$, $p < 0.001$).

Next, the elementary and secondary educators' responses for items related to infusion of technology were analyzed using the same nonparametric procedure. The results are as follows:

1. How often do you use the computer to generate student activities and projects?
    - $z = -5.13$, $df = 396$, $p < 0.001$
2. How often do you use the internet for school related purposes?
    - $z = -1.82$, $df = 397$, n.s.
3. How often do you check your school e-mail account?
    - $z = -6.21$, $df = 350$, $p < 0.001$
4. How often do students utilize the classroom computers for educational purposes?
    - $z = -0.87$, $df = 405$, n.s.
5. How often do you use the resources on the Internet?
    - $z = -3.03$, $df = 401$, $p < 0.002$
6. How often do you use a TV-VCR in the classroom?
    - $z = -4.69$, $df = 385$, $p < 0.001$
7. How often do you use a digital camera or DVD in your classroom?
    - $z = -5.34$, $df = 392$, $p < 0.001$

Note: The negative values of the "z" test indicate that the scores of the secondary school teachers were higher than the scores of elementary school teachers**.**

Correlation analysis was used to describe the relationship between the reported levels of skill that teachers had with instructional technology, with the teacher's reported level of home use of computer technology. Correlations were also determined between those two variables (skill level and home use) and the degree to which those teachers incorporate instructional technology into their teaching. Table 1 presents a matrix of correlations between these variables.

An anomaly is evident in these correlational data. The variable, Student Use is an abbreviation for the question, "How often do your students utilize the classroom / laboratory computers for educational purposes?" The answer possibilities were scaled as: Very Frequently, Frequently, Occasionally, Rarely, Very Rarely, and Never. On close examination, over 400 teachers responded either Very Frequently or Frequently. This pattern removed the variance needed to have a meaningful interpretation of the data from that item.

Table 1

Correlations Between Teacher's Skill Level and Technology Infusion

		H	S	A	I	M	U	R	T	D
Home Computer Use	**H**	1.00								
Skill Level	**S**	0.69	1.00							
Activities & Projects	**A**	0.55	0.73	1.00						
School Internet Use	**I**	0.58	0.52	0.36	1.00					
Check E-mail	**M**	0.31	0.53	0.36	0.22	1.00				
Student Use	**U**	0.04	0.06	0.03	0.03	0.08	1.00			
Internet Resources	**R**	0.20	0.31	0.15	0.16	0.13	0.01	1.00		
Use of TV - VCR	**T**	0.49	0.62	0.46	0.33	0.32	-0.03	0.12	1.00	
Use of DVD	**D**	0.37	0.57	0.47	0.29	0.34	0.12	0.17	0.43	1.00

With a two tail hypothesis, correlation coefficients greater than $r = \pm 0.13$ are significant at or beyond the $p < 0.01$ level.

Beyond that utilization question, the correlational data indicated that the variables "teacher's skill level," "school Internet,"and "having a home computer system," account for a large portion of the variance in the use of instructional technology. To test the two possible hypotheses - home use of computers is the central factor in the use of instructional technology, and the competing hypothesis - skill level of teachers is central to their using instructional technology, a series of partial correlation coefficients were calculated. The first set of correlations held the "teacher's skill level" out of the analysis, and correlated the variable of "home computer use" with the variables for the integration of computers into classroom instruction. These correlation coefficients were uniformly

low with only the integration variable "How often do you use the Internet for school related purposes?" as being significant ($r = 0.35$. $df = 318$, $p < .001$).

When the analysis was conducted with the variable "home computer use" partialed out the correlation, the variable of "teacher's skill level" was found to be correlated significantly with all the variables, except that of "student use of computers" as noted above. The partial correlations can be found in Table 2.

Table 2

Partial correlations between "teacher skill level" and seven measures of technology infusion with the variable "home computer use" removed

- Activities and projects $r_p = 0.60$
- School Internet Use $r_p = 0.21$
- Checking school e-mail $r_p = 0.48$
- Student computer use $r_p = 0.07$
- Using Internet Resources $r_p = 0.17$
- Using TV-VCR $r_p = 0.52$
- Using DVD & Digital cameras $r_p = 0.51$

With a df of 308, and using a two tail hypothesis, correlations which are equal or greater than $r = 0.19$ are significant at the $p < 0.001$ level.

Conclusions

The teachers who work in the middle and senior high schools of this rural school district have a greater working knowledge of the software and instructional technology supported by their district than do the elementary school teachers. Also the secondary teachers employ more instructional technology in their teaching and are more apt to have a home computer with an Internet account than are the elementary level educators.

Possible personological variables that can explain this differentiation, including age, gender, and graduate education, remain to be explored in future analyses.

From these correlations it is evident that whether or not a teacher has a home computer is not the driving force in his or her use of instructional technology. When the factor of the teacher's reported skill level is removed from the relationship, the influence of having a home computer is minimized. The key issue is the knowledge level of the teacher regarding the technology tools the district provides. For that reason, the focus of in-service education should continue to be providing teachers with ongoing programs of continuing technology education. The natural tendency for some teachers to view classroom computers as "magic" typewriters must be changed (Norton, 2008). With a rural school system such as Granite Rock, having a continuous technology training education effort is even more critical than it is in suburban schools where there may be additional educational programs and staff development opportunities.

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Attachment 1: Survey

GRANITE ROCK SCHOOL DISTRICT
TECHNOLOGY STAFF ASSESSMENT
2006-2007

Name:_____ Grade:_____
(Please Print)

PLEASE COMPLETE THE FOLLOWING SURVEY QUESTIONS.

Home Use:

1. Do you have a computer at home? *Yes* *No*
(If NO skip to question 5)

2. Do you have Internet access at home? *Yes* *No*

3. Do you have a personal e-mail account? *Yes* *No*

4. How often do you use your home computer?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

School Use:

5. How often do you use the computer to generate student activities and projects?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

6. How often do you use the Internet for school related purposes?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

7. How often do you check your school e-mail account?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

8. How often do your students utilize the classroom/laboratory computers for educational purposes?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

9. How often do you use the resources available on the Internet?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

10. How often do you use a TV/VCR in the classroom/laboratory?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

11. How often of you use a digital or video camera in your classroom/laboratory?

Very Frequently *Frequently* *Occasionally* *Rarely* *Very Rarely* *Never*

PLEASE BEGIN THE SELF ASSESSMENT

12. Word-processing Skills (MS-Word)
I can…
_____ Create a new document
_____ Open an existing document
_____ Add text to a document
_____ Change fonts, sizes and styles
_____ Cut, copy and paste
_____ Save and print a document
_____ Save a document to another location
_____ Add graphic elements
_____ Check spelling
_____ Set line spacing
_____ Align text
_____ Use headers and footers
_____ Use bullets and outlines
_____ Check grammar
_____ Insert page breaks
_____ Create automatic page numbering
_____ Save documents in other formats
_____ Import other documents
_____ Create a table
_____ Use thesaurus
_____ Create templates
_____ Set margins
_____ Tile or stack windows
_____ Set indents
_____ Use smart quotes
_____ Create macros
_____ Change margins and tabs
_____ TOTAL CHECKED FOR ITEM 12

13. Spreadsheet Skills (MS Excel)
I can…
_____ Open a spreadsheet document
_____ Create a new spreadsheet document
_____ Enter data into a cell
_____ Navigate across columns and rows
_____ Use return to move down rows
_____ Change row and column size
_____ Save a document
_____ Save a document to another location
_____ Use arrow keys to move around

Spreadsheet Skills Continued…
_____ Insert and delete cells
_____ Format text, rows and columns
_____ Perform calculations
_____ Insert and delete rows and columns
_____ Cut, copy and paste data into cells
_____ Create a chart
_____ Format a chart
_____ Lock title position
_____ Use drawing tools
_____ Format numbers
_____ Set borders and shading
_____ Protect cells, rows and columns
_____ Lock cells, rows and columns
_____ Create sheets within other documents
_____ Create macros
_____ TOTAL CHECKED FOR ITEM 13

14. E-mail Skills
I can…
_____ Locate where email settings are entered
_____ Create a new message
_____ Check incoming messages
_____ Reply to messages
_____ Send messages from other folders
_____ Navigate through a message list
_____ Review old messages from the outbox
_____ Delete unwanted messages
_____ Empty the trash folder
_____ Use the “cc” option
_____ Forward messages
_____ Create and delete folders
_____ Change text color
_____ Change font size
_____ Insert a background
_____ Create an address book
_____ Open an attachment
_____ Create a group
_____ Send attachments
_____ Use spell check
_____ Flag messages
_____ TOTAL CHECKED FOR ITEM 14

Name:_____
(Please Print)

15. Web Browser Skills
I can…
_____ Enter a URL on the command line
_____ Scroll through a Web page
_____ Use the Back and Forward buttons
_____ Use hypertext links
_____ Change the size of the viewing window
_____ Open a window
_____ Use the refresh button
_____ Use the home button
_____ Print a Web page
_____ Use the history list
_____ Copy text and pictures
_____ Use the arrow keys to navigate
_____ Use the mouse buttons to navigate
_____ Add to Favorites
_____ Create folders
_____ Manage folders
_____ Delete folders
_____ Set a default web page
_____ Open a favorite
_____ Formulate and enter a search question
_____ Locate a search engine
_____ Evaluate search engines
_____ Use quotes, wild cards & Boolean logic
_____ Find curricular resources
_____ TOTAL CHECKED FOR ITEM 15

16. Utilizing The Network
I can…
_____ Log in to the network
_____ Access files on your network drive
_____ Upload and download files to your network drive
_____ Select a different printer if available
_____ Create and delete folders and files
_____ Log in from a different workstation
_____ Search for a document
_____ TOTAL CHECKED FOR ITEM 16

17. Presentation Skills (MS PowerPoint)
I can…
_____ Open a presentation document
_____ Create a new presentation document
_____ Use the presentation wizard
_____ Manually create a presentation
_____ Use the toolbars
_____ Insert a text box
_____ Save a presentation
_____ Save a presentation to another location
_____ Set slide layout
_____ Change slide layout
_____ Enter data into a slide
_____ Add transitions and animations
_____ Set slide timing
_____ Create hyperlinks
_____ Use draw objects
_____ Cut, copy and paste objects
_____ Check spelling
_____ Format text
_____ Add clip art
_____ Insert a chart
_____ Add sound and video
_____ Change background color
_____ Change color scheme
_____ Print handouts, notes, slides, or outlines
_____ Develop an entire presentation
_____ Set up the equipment for a presentation
_____ TOTAL CHECKED FOR ITEM 17

18. Universal "Common" Operations
I can…
_____ Navigate through menus

_____ Move cursor through text
_____ Use online help
_____ Highlight text
_____ Create a file
_____ Set fonts at beginning of file creation
_____ Retrieve files from various locations
_____ Enter, edit and delete text
_____ Use find and replace function
_____ Use the number pad appropriately
_____ Modify page setup
_____ TOTAL CHECKED FOR ITEM 18

19. Database Skills (MS Access)
I can…
_____ Create a database structure
_____ Open a database
_____ Enter data into a database
_____ Save and print
_____ Create a report
_____ Cut, copy and paste data
_____ Merge data into another application
_____ Enter a field name
_____ Select data type
_____ Enter a description
_____ Use the table wizard
_____ Enter field data
_____ Create a query
_____ Create a form
_____ Use the toolbar
_____ Use macros
_____ Create data across pages
_____ TOTAL CHECKED FOR ITEM 19

20. Computer Operation Skills
I can…
_____ Start up and shut down the computer
_____ Identify and use icons and menus
_____ Use directional keys to navigate
_____ Use a mouse

Computer Operation Skills Continued…
_____ Move files in and out of folders
_____ Create, rename and remove folders
_____ Create, rename and remove files
_____ Work with multiple applications
_____ Use a scanner
_____ Replace printer ink or toner cartridges
_____ Determine available memory
_____ Determine available disk space
_____ Backup data files
_____ Use the find option to locate files
_____ Create folders within folders
_____ Connect peripherals to the computer
_____ Modify printer settings to alter output
_____ Install and uninstall applications
_____ Create duplicate/alias icons
_____ Add, change and rename icons
_____ Identify a path, file and folder
_____ Identify the desktop components
_____ Launch programs and applications
_____ Open a CD-ROM application
_____ Close programs and applications
_____ Insert and eject floppy disks and CDs
_____ Format or initialize floppy disks
_____ TOTAL CHECKED FOR ITEM 20

21. How comfortable do you feel with the following programs?
1 = Extremely Poor; 2 = Below Average; 3 = Average; 4 = Above Average; 5 = Excellent;

A. Performance Tracker	1	2	3	4	5
B. Compass / Plato	1	2	3	4	5
C. Nettrekker d.i.	1	2	3	4	5
D. Unitedstreaming	1	2	3	4	5
E. Pentamation (TAC)	1	2	3	4	5
F. CPEtracker (ACT 48)	1	2	3	4	5
G. DOCUshare	1	2	3	4	5

What technology in-service programs would you like to see offered in the near future?

Comments:

[i] Although the data examined in this study is accurate and true, the Superintendent of Schools has requested that the district name remain confidential.