Technology's Impact on Human Resource Development across the Life Span: Pedagogy Starts with Andragogy

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Technology impacts human beings across their life span. Technology integration begins at birth and continues to be a vital part of human existence until the grave. This study examined the effects of andragogy and pedagogy learning as it relates to human resource development. The study evaluated the effects of andragogical professional development for the teacher and its relation to improved pedagogical learning for students in the classroom.

Keywords: Andragogy, Pedagogy, Technology

Human Resource Development (HRD) programs are faced with overwhelming challenges as there is a dearth of computer literate employees to meet the growing demands of the workplace. In other words, many employees are technologically and computer challenged thus impeding the instruction and learning process. Innovative organizations utilize computer technology in their initial and ongoing training programs. This computer knowledge deficit increases the cost burden of initial and on-going training. Luskin (2002) emphasized that "knowledge is recognized as a key to a company's competitive advantage and acknowledged as a key human capitol asset." When this human capitol knowledge is missing a human knowledge deficit exists.

Problem Statement

Employers are faced with the expectation to meet the growing demand of workplace orientation and training programs. Many institutions have expanded across the globe, creating a need to utilize the Internet and other technologies in training efforts. Luskin (2002) discussed how the Internet impacts learning for work and school including pre-K through adult.

The workforce of today and the future is in desperate need of computer literate employees. Therefore, it is crucial for pre K thru university level education to prepare students to meet the workforce demands. Computer technology deficit is defined, herein, as the lack of knowledge to utilize computer hardware and software to access and interact efficiently with computer orientation and distance training learning modalities. This study was undertaken to determine whether formal professional training of teachers would effect the utilization of technology by teachers and students thus leading to increased student computer literacy and academic performance.

Theoretical Framework

Kleiman's (2000) research of the long-term Apple Classroom of Tomorrow (ACOT) study identified five stages of instructional evolution: entry, adoption, adaptation, appropriation, and intervention. As instructors progress through these stages significant professional development, training, and support is needed. There is a central tendency to exaggerate the potential that computer technology has to enhance teaching and learning without recognizing the complex, multifaceted task of turning that potential into reality through carefully planned, long-term administrative commitments.

Pedagogy

The TEA established Education Standard guidelines that state the educator will demonstrate the ability to integrate technology utilizing assessments in Pedagogy and Professional Responsibilities. (Texas Education Agency, 2005). Pedagogy is the art or science of teaching children. In ancient Greek pedagogy referred to the taking of children to and from school. (Dictionary.LaborLawTalk.com 9/14/2005).

Nakibogul & Karakoc (2005) express the importance of pedagogical content knowledge (PCK) which they refer to as a fourth knowledge area. The basic three areas include content, pedagogical, and general cultural. PCK is described as the teacher's understanding of four components of pedagogy: subject matter, content, student characteristics and the environmental context of learning.

Andragogy

The theoretical framework utilizes andragogy. Malcolm Knowles defines adult education as "the art and science of helping maturing human beings learn" (1975, p. 85). Knowles (1980) describes the andragogical model "as research-based knowledge about adults as learners following alternative assumptions that differ from the previous pedagogical model" (p. 48). Knowles further explained that the term andragogy was "derived from the Greek word for adult—aner" (p. 48). Even back in 1975 Knowles further elaborated that "learning opportunities must be made available to adults at times and places that are convenient to them and that provide easy entry and exit" (p. 85).

Swanson & Holton define HRD as a "process of developing and unleashing human expertise for the purpose of improving performance" (2001, p. 385). Luskin cites Jeanne Meister, a corporate university expert, in her discussion "Changes are taking place in the American education market place. The business community recognizes that it is suffering more than ever before from the early learning inadequacies and their residual effects manifested by the limited educational proficiencies of young people and workforce training" (2003, p. 159). "The articulated link between early learning, education and workforce training presents an interesting correlation" (Luskin, 2003, p. 159). Technology–enhanced instructional settings have a different culture and expectation than traditional instructional settings.

The ACOT study indicated use of computer technology resulted in new learning experiences requiring higher level reasoning and problem solving, positively impacted participant attitudes and changed teacher methodology from lecture format to more cooperative group work (Schacter, 1999). The Texas Education Agency (TEA) outlined the Texas Long-Range Plan for Technology, 1996-2010, that called for higher standards for educator preparation and development, increased infrastructure for technology, administration and support services, and specific objectives in teaching and learning to ensure that all Texas high school graduates are computer literate. The sequence of K-12 student expectations is defined in the Texas Essential Knowledge and Skills (TEKS). The TEKS are available for students K-12 which include areas of foundations, information acquisition, problem solving and communication and publishing. (Texas Education Agency, 2005).

Research Questions

1. Did the professional development that the teachers received increase their ability to utilize technology in the classroom?
2. Did the teacher's utilization of technology in the classroom increase?
3. Did the student's utilization of technology increase?
4. Did student Texas Assessment of Knowledge and Skills (TAKS) scores increase?

Methodology

Assessment measures were established by the Texas Education Agency for use in the Technology Applications Readiness Grants for Empowering Texas (TARGET). These determined, to a large extent the methodology employed in this study. The study findings are based on two primary assumptions. Assumption No. 1: Teachers and students answered the survey questions truthfully. Assumption No. 2: The researchers were not biased in their data evaluation process.

The study examined the effects of introducing the additional technology and computing resources into the instructional setting including the resulting changes to instructional processes and infrastructure. To this end, several instruments and data sources were utilized. The study employed both quantitative and qualitative techniques, included surveys, open ended questions and Instructional Unit Plans.

The school districts and teachers that form the sample for this study were participating in a Technology Applications Readiness Grant for Empowering Texas (TARGET) funded by the Texas Education Agency.

Participants

This study involved 3,585 students and 37 teachers from nine participating campuses in Texas. The campuses were randomly selected from school districts in the target geographical area that fell within the criteria of the TARGET grant. Teachers participating in the study were nominated and asked to take part by school administrators. All participating teachers taught in one or more of the core subject areas specified in the TARGET grant.

Instrumentation

Three instruments were utilized in the course of this study. The first instrument used was a survey completed by all participating teachers. This was an existing survey used with the permission of the Texas Center for Educational Research. This tool was developed by the Texas Center for Educational Research and was utilized in

their Technology Integration in Education Initiative (TIE) statewide survey report (Texas Center for Educational Research, 2003).

The survey instrument provided an evaluation of the integration of technology into the classroom and curriculum by the participating instructors. It was administered the beginning and at the end of the school year.

These surveys contained 85 items. The items included: demographic information, four- and six-point Likert scale questions as well as open-ended interview questions. Of the 85 items on the survey, 6 Likert scale questions provided specific measures of the use of technology in the instructional setting. Responses to these questions are summarized in Table 2 in the Findings section. Ten Likert scale (4-point) items measured the teacher's evaluation of the usefulness of the professional development and ability to transfer the material to their classroom and delivery of content. These items are summarized in Table 1 in the Findings section.

Surveys included questions to measure utilization of technology in the instructional process. The questions addressed (1) improvement in the use of technology in developing lesson plans; (2) integration of technology into the curriculum; and (3) utilization of technology in lessons. Survey results were summarized and are reported below in the Findings section under Research Question No. 2.

The second instrument was a student survey which allowed students in participating classes to report on their use of technology in the classroom as well as their instructor's use of technology in content delivery. This survey contained 51 items. Of those, 10 related specifically to the students use of computers and other technology. The results may be found in the Findings section under Research Question No. 3.

The third instrument utilized in the study consisted of Instructional Unit Plans (IUP). These unit plans were used to document the utilization of technology in the classroom and curriculum. A template for the creation of the IUPs was provided to each of the instructors. This was done to ensure a level of consistency in the reporting. Instructors submitted IUPs periodically throughout the year. Results are reported below in the Findings section under Research Question No. 3.

Procedures/Treatment

Teacher technology surveys were administered in the fall of the year (n = 36) and again in the spring of the following year (n = 36). The results were compared to determine whether there had been a change in the use and/or effects of technology during the year.

The pre and post surveys were hand scored and the data entered into a spreadsheet for convenience of processing since spreadsheet software is readily available. The spreadsheet data was then transferred to SPSS for analysis.

Measures of central tendencies, including mean, standard deviation, and variance, were computed for pre- and post counts reflecting instructor access to resources in twelve resource categories. These same measures were performed on six items related to instructor use of available resources (see Table 2). In addition, t-tests were performed at .05 level on the previous mentioned data items.

Student technology surveys were administered using scantron forms. The surveys consisted of 51 items including demographic information open-ended questions and Likert scale responses related to the availability and usage of technology in the classroom. Of the Likert scale items, 10 specifically addressed the student's use of technology. The completed forms were scanned and loaded into an Excel spreadsheet. Better than 90% of the forms scanned successfully and were usable. After editing and verification, the data was transferred from Excel into SPSS for analysis.

IUPs were completed by teachers throughout the academic year to document details of lesson plans, including content to be covered, student assignments, and technology utilized within the lesson. The IUPs were divided into two groups, representing the first and second half of the academic year. All IUPs were reviewed and notations made of the use of each type of technology that was incorporated into the lessons. Attention was given to both the use of technology in content delivery and within student assignments. Each use of a particular type of technology was entered into an Excel spreadsheet and the results were summarized.

Limitations

The study was limited to nine rural high schools (thirty six instructors plus one mentor instructor) and nine campuses.

Findings

Research Question No. 1

Did the professional development that the teachers received increase their ability to utilize technology in the classroom?

The following table represents the teacher's assessment of the value of professional development that they received. It represents a summary of their perceived ability to utilize technology in the 10 functional areas listed. The 0.18 mean change represents an 8.5% increase in the perception of their technical competence.

Table 1. *Usefulness of Professional Development*

	Pre Survey		*Post Survey*		
	Mean	*n=*	*Mean*	*n=*	*Change*
Use Basic Applications	2.65	36	3.03	35	0.38
Using Multimedia	1.68	36	2.22	35	0.54
Administrative Records	2.94	36	2.67	35	-0.27
Lesson Plans	2.15	36	2.03	35	-0.12
Content Specific Applications	2.32	36	2.83	35	0.51
Integrated Technology	1.76	36	1.92	35	0.16
Using the Internet	2.44	36	2.72	35	0.28
Theories/Methods	1.71	36	2.08	35	0.37
Improve Student Skills	1.68	36	1.44	35	-0.24
Advanced Telecom	1.38	36	1.53	35	0.15
			Mean Change		*0.18*

Research Question No. 2

Did the teacher's utilization of technology in the classroom increase?

The assessment tools and guidelines of instructor self reporting were established by the Texas Education Agency as was previously noted in the methodology section. Table 2 summarizes responses of instructors to questions involving specific measures of the use of technology in the classroom. The table demonstrates the perception of the teachers in that, for each of the six measures of technology utilization, instructors reported a significant increase from the beginning to the end of the academic year. Each of the six items was found to be significant at the .05 level.

Table 2.*Increase In Instructor Use of Technology*

	Pre Survey		*Post Survey*				
	Mean	*n=*	*Mean*	*n=*	*Increase*	*t*	*Sig*
Lesson Plans	3.66	35	3.97	35	0.31	20.538	p<.05
Instructional Materials	5.31	36	5.53	36	0.22	87.702	p<.05
Internet Use	4.61	36	4.72	36	0.11	39.880	p<.05
Model Lessons	3.75	36	4.14	36	0.39	29.438	p<.05
Multi Media Presentations	3.00	36	3.86	36	0.86	20.609	p<.05
PowerPoint Presentations	2.75	36	3.39	36	0.64	19.816	p<.05

Table 3 represents a summary of the utilization of technology in the curriculum as reported on IUPs. Eight of the nine categories of technology that were identified in the IUPs showed an increase in usage from the beginning to the end of the academic year. The only exception was the use of Zip Drives which actually decreased somewhat.Table 3.

Summary of Technology Usage – Instructional Unit Plans

Use of Technology by Instructors	*Instructional unit plans 1-4*	*Instructional unit plans 5-8*
Microsoft Word® (word processing)	100%	100%
Microsoft Word® (instructional unit plans)	100%	100%
Microsoft Word® (student handouts)	33%	100%
Microsoft Word® (student Homework)	33%	100%
Microsoft Word® (student Exams)	33%	100%
Microsoft PowerPoint®	32%	63%
Microsoft Excel®	0%	34%
Internet Search (student homework)	21%	67%
Zip Drive	46%	33%

Research Question No. 3

Did the student's utilization of technology increase?

The following table demonstrates that student use of technology in the classrooms increased significantly in eight of the 10 areas measured. There was a slight decrease in one item – use of scanners and digital cameras. One additional item, use of graphing calculators was found not to be significant at the .05 level.

Table 4. *Increase In Student Use of Technology*

	Pre Survey		*Post Survey*				
	Mean	*n=*	*Mean*	*n=*	*Change*	*t*	*Sig*
Use a word processing program like Word.	4.06	1955	4.50	590	0.44	11.505	p<.05
Create desk top publishing products	4.20	1941	4.52	587	0.32	8.033	p<.05
Create multimedia reports/projects (like HyperStudio)	3.86	1937	4.33	592	0.47	6.237	p<.05
Create PowerPoint presentations	3.87	1929	4.08	587	0.21	8.937	p<.05
Create charts or graphs	3.11	1919	3.67	589	0.56	3.547	p<.05
Use the internet for research	3.50	1919	4.07	585	0.57	8.871	p<.05
Use a computer to learn and practice skills	4.03	1904	4.45	587	0.42	8.914	p<.05
Use a computer to review for TAKS	3.29	1919	3.36	588	0.07	7.290	p<.05
Use a graphing calculator	4.17	1857	4.67	586	0.50	0.953	NSI*
Use a scanner or digital camera	2.97	1897	2.93	588	-0.04	8.747	p<.05
					0.35	*Mean Change*	

** = Not Significant at .05*

Research Question No. 4: Did student TAKS scores increase?

Pre (Fall 2003) and Post (Spring 2004) TAKS test results. The results demonstrated improvement in student academic achievement by subjects as supported by the quantitative comparison of TAKS for these years.

Table 5. *Comparison of Pre and Post TAKS Scores by Subject*

Field of Study	*TAKS Pre 2003 (Mean)*		*TAKS Post 2004 (Mean)*		*Change*
	n =		n =		
Math	2,296	62.59	2,173	67.96	5.37
Reading	2,213	76.67	2,551	79.81	3.14
Science	1,430	63.55	1,454	70.17	4.22
Social Studies	1,449	82.11	1,457	91.50	9.37
All Fields of Study (Mean)	7,388	71.23	5,666	77.36	6.13

The documented mean values for the pre (Fall 2003) TAKS scores and the post (Spring 2004) TAKS scores for the nine school districts in the fields of study which were evaluated demonstrated significant improvement.

- The math scores showed an overall mean improvement from the pre TAKS 2003 to the post TAKS 2004. The ninth and tenth grades showed a slight reduction in the mean value; however, the eleventh grade showed a significant improvement.
- The reading scores showed an overall mean improvement from the pre TAKS 2003 to the post TAKS 2004. The ninth and tenth grades showed a slight reduction in the mean value; however, the eleventh grade showed a significant improvement.
- The science scores showed an overall significant improvement from the pre TAKS 2003 to the post TAKS 2004. The tenth grade showed a slight reduction in the mean value; however, the eleventh grade showed a significant improvement.
- The social studies scores showed an overall significant improvement from the pre TAKS 2003 to the post TAKS 2004. The tenth grade showed a slight improvement in the mean value and the eleventh grade showed a significant improvement.

The above data lends support to the statement that pedagogy starts with andragogy. As the student nears graduation significant improvement has been made toward assisting to prepare the young adult for the employment market or to prepare for entrance into college. Teachers through professional development utilizing andragogy gain increasing knowledge and skills to prepare the student for improved TAKS testing.

Conclusions

While no causal relationship is suggested or assumed, it is noted that following the teacher's professional development there was a 10.9% increase in the teacher's use of technology, a 9.4% increase in student use of technology, and an 8.6% improvement in TAKS scores. The study found that the provision of professional development in the use of computing/information technology in the instructional setting had a significant impact on the ability of the instructors to utilize technology in content delivery. The authors believe that the educational experience in those teachers' classrooms was enriched and became more challenging for the students. This was indicated by the fact that instructors integrated the use of the technology into their curriculum when it was made available, when adequate teacher technology support training was provided and that as a result the teachers modified their instructional format to take advantage of the diverse opportunities afforded them through the availability of these technologies.

Teachers at all levels and in all educational settings face many of the same professional challenges and constraints including budgets, class sizes, time, and a desire to constantly improve the quality and effectiveness of content delivery. They also have at their disposal many of the same methods and techniques. Based on the findings in this report, it is additionally the authors belief that by making technological tools available, along with appropriate professional training in their use, instructors will use them to enrich their delivery and adopt new and diverse teaching methods. The availability of technology provides options for instructors at any level and in any environment.

The NCLB historic education reform of 2001 funds opportunities and supports the professional development of instructors in relationship to improvements in technology integration. HRD, through these computer/technology funding programs, improves the professional development of teachers, provides many opportunities for increased access and availability of technology for teachers in the instructional development.

Recommendations

Recommendations include continued support for teacher professional development in utilization and set up of the technology infrastructure. Utilization improvement was noted in the curriculum development after professional development training on computer/technology was provided. A longitudinal study to determine whether these teachers continue to utilize the technology over an extended period is recommended. Additionally a longitudinal study to determine the longer term effects of the introduction of technology on the students who participated in the grant is recommended. It is recommended that research be continued to evaluate the integration of this younger population in the utilization of computer technology as they enter the workplace. A study to determine whether additional professional development provided the teachers during the year would be beneficial.

Implications for HRD

HRD in the workplace is facing many computer technology challenges. The data contained within this manuscript represents a segment of government and educational reform in process to improve academic instruction (pedagogy) leading to increased computer technology savvy applicants for hire into the workforce. This research supports a move toward human resource development andragogy technological applications in workplace learning by advancing the professional development of teachers in K-12.

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