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Using pedagogical dialogue as a vehicle to encourage faculty technology use

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ABSTRACT

The pace of technology adoption by university faculty is often slow. Slow faculty technology adoption may result from fear of failure, disinterest, or aversion to change. However, in 2007 we experienced a different faculty response while training faculty for technology-enhanced teaching at Butler University. During a technology upgrade of classrooms on our campus, we installed SMART™ interactive whiteboards and Sympodiums™ (SMART Technologies), visual presenters and CopyCams™ (Polyvision/Steelcase). The technology trainers and information technology (IT) department anticipated a lack of faculty interest in training on these technologies. It was posited that faculty would not be interested in learning about these interactive and presentation technologies unless this learning could be connected in some way to their individual teaching interests and responsibilities. A novel, collaborative training model was developed to achieve this goal of placing technology training into a pedagogical context. A multidisciplinary group of faculty, working closely with representatives from IR, served as trainers for this highly successful faculty development effort in which 27% of the university faculty were trained over a three month period. This article details the methods and outcomes of this collaborative training team approach.

1. Introduction

According to Green (2006), assisting faculty to integrate technology into their teaching continues to be one of the most important issues facing campus technology planners. Successful faculty technology training recognizes the need to develop two essential areas of faculty expertise – technological skill and effective technology integration into pedagogy (Chuang, Thompson, & Schmidt, 2003; Guernsey & Young, 1997; Keengwe, 2007). In addition, research on professional faculty development suggests that purposeful technology training must include learning by doing, establishing relevancy to specific roles and responsibilities, modeling effective instructional strategies, and providing ongoing support (Brown, 2008). Simultaneously, educators understand that it is now a necessity for faculty to possess specific technology skills in order for them to be effective teachers (Britten & Craig, 2006; Molenda & Sullivan, 2000).

During the fall of 2006 a campus-wide survey of faculty and students identified three critical technology issues facing our private midwestern university campus (Kheiry & Britten, 2007). These three areas are access to faculty technology training, avenues for sharing knowledge and experiences with new technologies, and technology-enhanced learning space design. Data from the report were used to prioritize the work of the instructional technology (IT) team within the campus computing office, information resources (IR). A priority for the IT team was to identify a point of entry or faculty access point through which they could model technology innovation and faculty skill development.

This article is a summary of the planning, implementation and outcomes of a major point of entry initiative within the College of Business Administration (CBA). This initiative, a campus-wide effort to improve technology integration by faculty through pedagogical dialogue, has led the authors to better understand technology integration and faculty skill development as a complex integration of campus planning, communication, IT–faculty collaboration, and evidence-based education.

2. Context of the study

A grant from the Lilly Foundation was awarded to Butler University's College of Business Administration to improve physical facilities and student learning. The grant included a budget line for capital improvement which was used to upgrade the CBA building and several

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campus classrooms used routinely by CBA faculty. Upgrades were contextualized around the improvement of student learning and the changing infrastructure needs of students to facilitate their learning.

3. Student learning and learning space design

In the article *Leading the Transition from Classrooms to Learning Space*, Oblinger (2005) suggests that by addressing the following four critical questions, the best learning infrastructure design decisions can be made.

- Does your learning space enable learners to get to know each other and engage in dialogue?
- Does your learning space enable learners to work on group projects?
- Does your learning space enable learners to interact in a variety of ways such as collaborative or cooperative learning?
- Does your learning space enable learners to present their work publicly, teach others, or give feedback?

Oblinger suggests that design choices must be made to support the idea that learning is social and that active learning involves student interaction with real-world problems through which learners practice and receive feedback from peers and experts. It was with this understanding and in this context that the CBA learning infrastructure was re-envisioned.

4. Millennial student learning preferences

Another factor considered in upgrading the CBA building and redesigning its classrooms was the changing nature of students and their current learning preferences. A review of the literature on teaching the millennial or Net Generation student, students born after 1982, demonstrated that current 18–22 years old college students are collaborative, technologically sophisticated, experiential, multi-taskers who are team-oriented and concerned about social issues (Howe, Strauss, & Matson, 2000; Oblinger, 2008; Strauss, 2001; Tapscott, 1998; Tenofsky, 2005; Tucker, 2006). Research supports the concept that as educators we must create learning environments that expand opportunities for student collaboration, design more purposeful opportunities for integrating technology into millennial student learning, and provide more actively engaging and experiential learning opportunities in order to effectively teach millennial students (McGlynn, 2005; Oblinger, 2008; Oblinger & Oblinger, 2005; Skiba & Barton, 2006).

Prensky (2001) explains that the differences in technology acceptance of students and faculty can be contextualized in the framework of digital natives and digital immigrants. Digital natives are persons usually under the age of 30 who "have spent their entire lives surrounded by and using computers, video games, digital music players, video cams, cell phones, and all the other toys and tools of the digital age." Prensky notes that "Today's average college grads have spent less than 5000 h of their lives reading, but over 10,000 h playing video games (not to mention 20,000 h watching TV)." In addition, Prensky argues that as a result of prior technology-related experiences the digital native processes information differently from the digital immigrant. By contrast, most faculty are described by Prensky as digital immigrants, persons who have not grown up with digital technology as an ever present part of their environment and who are often less comfortable with technology use than digital natives.

Strommen and Lincoln (1992) suggest that university teaching has changed very little over the past 20 years, creating a sense of estrangement between current student learning preferences and collegiate learning experiences. Only through reengaging the millennial student in a learning environment that acknowledges their learning preferences will we be able to create lifelong learners who effectively use their technological expertise and millennial student attributes. The goal of the CBA redesign project was to facilitate this reengagement through the deployment and use of technology in a constructivist learning environment, one that encourages active student engagement and that enables students to ask questions, develop projects, and invest in real life activities or simulations. Thus because of the learning preferences of current college students, both the methods of teaching and the tools used to implement these methods must be altered to reflect the collective pre-college experiences of our students.

5. Developing a shared vision among project stakeholders

According to Brown (2008) the first step in creating meaningful change with technology and learning is the development of a vision for change. The CBA project did not create a new vision statement for the college, but rather it carried forward the college's existing vision, *Real Life, Real Business*, and the central mission of the university, *teaching*. There were two groups of project stakeholders. College stakeholders included the Dean, Associate Dean, and critical faculty members with direct curricular responsibility to the CBA students. University stakeholders included the Chief Information Officer, the Interim Director of IT, and members of IR that were critical to the decision making processes for planning and deployment of the technology infrastructure. The project leadership team comprised representatives from each of the two stakeholder groups.

In order to reshape the leadership team's perspectives on learning space design and to facilitate their understanding of how learning space design influences student learning, the team visited Steelcase University in Grand Rapids, Michigan. During this shared experience, the leadership team was able to better understand the relationships between learning space design and student learning behaviors. The on-site visit made it possible for team members to personally experience the design results from recent learning infrastructure research and to understand that there are important connections between physical environment and learning (Guernsey, 2005; Huang, 2004; O'Donnell, 2001; Oblinger, 2005). The team toured experimental classrooms and nonclassroom learning spaces on the Steelcase campus and at a local university campus. As a result the team was able to better understand the critical issues regarding how students use learning spaces, how positioning of tables and chairs in a classroom impacts instructor and student behaviors and student engagement, and how changes in physical room arrangement can facilitate or deter student collaborative interaction. Because the physical classroom and technology redesign was part of a more global initiative to improve student learning in CBA, it was understood by the leadership team that physical and technological infrastructure must be developed in tandem with the technology knowledge and skill set of the CBA faculty. At the onset of our campus-wide work to improve technology integration into teaching, there was no organizational connection between faculty technology training, faculty–IT collaboration, and classroom design. That is, up to this time we had viewed the use of instructional technology as an "add-on" to the pedagogical choices of faculty and not as an integral part of it. Faculty technology training took place in the absence of a pedagogical context. There was haphazard and serendipitous sharing of technology skills among faculty and there was little thought given to how classroom design could transform the way faculty teach and the way students learn.

The Steelcase University visit was an epiphany for the leadership team. The university facilities planning group and the university technology group in charge of the technological mediation of classrooms had not thought of classrooms in terms other than square-footage and lecture-based pedagogy. The simple reframing of classrooms as interactive learning spaces created a dynamic change in our approach to classroom redesign. The leadership team began to understand learning as a constructivist process rather than simply a lecture or information delivery event.

In order to create meaningful campus change and to integrate the processes of faculty technology training, IT–faculty collaboration and learning space design, the leadership team created a timeline whereby physical space redesign would happen simultaneously with efforts in technology training and pedagogical redesign. This process redesign reflected a change in university practice. Previously, the university had deployed new technologies into classrooms with little or no faculty training in the newly mediated classrooms. In addition, previous university technology training had focused primarily on specific enterprise solutions such as course management systems or specific computing programs. Intentionally aligning physical space redesign with anticipated changes in instruction reflected a transformational change in philosophy among the leadership team.

6. From leadership to implementation

As the leadership team refined its learning and space design philosophy, it had to also consider the campus-wide goals of developing appropriate faculty technology training and creating avenues for faculty sharing of knowledge and experiences with new technologies. Building on the work of Epper and Bates (2001) the leadership team strategically structured pedagogical change to occur using a faculty-to-faculty training model that encouraged faculty to practice technology based skill development using new technologies within their own content area and in a context that was relevant to their unique roles and responsibilities. By creating an implementation team of faculty trainers working closely with representatives from IR, responsibility for improving faculty integration of technology into pedagogy moved from being the vision of the leadership team to the responsibility of the implementation team. Faculty representatives to the implementation team, i.e. faculty trainers, were identified by campus Deans. Each faculty trainer was asked to participate in a two-day training session that was intended to focus the group on creating a shared framework for pedagogical dialogue and providing hands-on learning experiences within a training room that resembled a redesigned CBA classroom learning space. Technology training was focused on trainers being able to effectively use and integrate the following technologies into their teaching: SMART™ interactive whiteboard and Sympodium™ (SMART Technologies), Elmo™ visual presenter (Elmo LTD) and CopyCam™ (Polyvision/Steelcase).

As suggested by Sprague (2004), often there is a disconnect between what faculty view as their informational priorities about integrating technology into their teaching and the natural inclination of instructional technology professionals to focus on technology and not its pedagogical integration. To address this potential disconnect, the cohort of faculty trainers worked in collaboration with a member of the IT department. The intention was to provide faculty-to-faculty sharing of ideas and experiences with new technologies, to create technology training that focused on a pedagogical dialogue instead of only on technology skill attainment, and to create experiences whereby faculty were able to observe collaboration between their work and the IT department. Since the IT implementation team member actively participated in all faculty training sessions, this team collaboration and constancy of participation insured sustainability and uniformity of skill training while developing a dialogue about teaching and learning among the faculty and faculty trainees.

7. Technology training design

Several meetings were held with the faculty trainers and IT representative who were members of the implementation team to develop the training goals and strategies. The multidisciplinary faculty members of the implementation team were each given a modest stipend for their development time and the training sessions they delivered. The implementation team meetings were initially difficult because the discussions reflected diverse trainer perspectives and experiences and they focused primarily on what training was to be done rather than how it was to be done. Eventually a shared vision emerged of how the training would be delivered together with an outline of the knowledge and skill development that became the expected outcomes of the training sessions.

This planning work was facilitated by surveys previously collected from the faculty by the IT department. This survey information served to inform the trainers as to which technologies faculty were already most familiar with, thus aiding the trainers in prioritizing and allocating time to their various training goals. A strong desire to have faculty experience the new CBA classroom design and to learn with a hands-on learning strategy was incorporated into the technology training curriculum. Since the implementation team trainers were faculty, they evaluated each proposed training strategy in the context of their own feelings and experiences about how they wanted to learn and be taught. There were discussions about faculty fears of appearing inept with technology and about their general unwillingness to expose themselves to possible failure in front of their peers. Strategies were developed to manage and mitigate the potential for faculty failure and their fear of failure. This extensive planning conversation among the implementation team trainers resulted in the development of a training program that was designed to achieve the learning outcomes listed in Table 1.

Several aspects of the technology training sessions were unique to this collaborative training model. For example, it was decided to have an IT representative participate in all training sessions and for them to be available for one-on-one faculty training between the two required training sessions. This IT representative was also sent for training to SMART technologies to achieve a high level of expertise and familiarity with the technology so that they could effectively teach and assist both trainers and trainees. It was comforting to the trainers who were also novices with the technology to have the IT implementation team member in the training room during all training sessions. In addition the faculty trainers were more willing to delve deeper into the capabilities of the technology because they had the assurance that the IT team member would assist them if they encountered difficulty. This created a high level of comfort and a more relaxed and collaborative atmosphere for everyone involved with the training sessions while minimizing fear of failure for both the trainers and the trainees.

Table 1
Pedagogy and technology training outcomes.

At the end of this training the participants will be able to	
1	Discuss how technology in the classroom can either enhance or change pedagogy
2	Explain how the physical learning environment can facilitate learning
3	Describe the basic function and utility of the Elmo visual presenter, AMX control panel, Sympodium, SMART Board, and CopyCam
4	Calibrate the SMART Board (SB)
5	Demonstrate proficiency in writing, erasing, and highlighting on the SB
6	Annotate various file types using the SB
7	Attach files to a SMART Notebook file
8	Record a whiteboard image using the CopyCam
9	Obtain a Google Account
10	Discuss the collaborative utility of Google Documents and Spreadsheets
11	List the Seven Principles of Good Practice for Undergraduate Education
12	List technology resources for implementing the Seven Principles of Good Practice in Undergraduate Education
13	Find the web site that discusses pedagogical implementation of the Seven Principles
14	Find the web site that makes SB Tutorials available
15	Find the 5 min workshops on the Teaching–Learning–Technology (TLT) web site
16	Prepare SB materials in advance and outside the classroom using SMART Notebook software on the faculty office computer
17	List at least two ways you could utilize the newly learned technology to impact your teaching

7.1. Training design modeled Seven Principles teaching

Pedagogical outcome goals were based on the Seven Principles of Good Practice in Undergraduate Education (Chickering & Gamson, 1987). These principles were incorporated into the design of the training and they were taught to trainees as behavioral goals they should attempt to incorporate into their teaching. These Seven Principles are:

1 Encourage contact between students and faculty.
2 Develop reciprocity and cooperation among students.
3 Use active learning techniques.
4 Give prompt feedback.
5 Emphasize time on task.
6 Communicate high expectations.
7 Respect diverse talents and ways of learning.

The faculty trainers modeled Seven Principles teaching in their training sessions. Examples of Seven Principles teaching strategies employed in the training sessions included group discussions and group reporting on trainee reading assignments (cooperative learning), trainer and trainee feedback on trainee mini-class presentations (prompt feedback), an emphasis on out-of-class preparation by the trainees (high expectations with time on task), and opportunities for in-class hands-on experiential learning of technology skills (active learning).

7.2. Training design modeled millennial student learning preferences

Pre-training reading assignments on constructivist and Seven Principles teaching were provided digitally to trainees. This strategy helped create a common learning context for the trainees and assisted them in understanding the goals that they needed to attain during the training. Trainers created cooperative learning activities using the reading assignments and referenced the assignments during the training sessions to elaborate on concepts and to encourage a conversation on constructivist teaching, the Seven Principles and millennial student learning.

The training focused on hands-on learning and the social, collaborative learning modeled the experiential learning preferences of millennial students. Each trainee was given the opportunity to physically interact with the technology and was encouraged to spend time with the IT team member between the two 2-h sessions to develop their personal technology skills. Trainees were also given homework to complete between the two 2-h training sessions that required them to visit the training room and to interact more extensively with the technology either alone or with the IT team member.

The trainers modeled best practice teaching based on the Seven Principles utilizing the common technology training outcomes identified in Table 1. The trainers personalized their individual training sessions around the attainment of these outcomes and each faculty trainer was allowed to develop their own teaching materials and methods. At times trainers attended each other's training sessions and compared what was and was not working effectively in the various training sessions. By the end of the training period, all members of the implementation team, both faculty and IR members, had evolved into a cohesive work team.

As alluded to above, the training design employed two 2-h sessions. The first session focused on demonstrating and experiencing the new technologies. Pedagogy was used as the vehicle to demonstrate the technology. As a result the technology demonstrations were not focused just on how to use the technology but rather on constructivist teaching with specific examples of how the technology could be used to develop one or more of the Seven Principles. At the end of the first session, trainees were assigned homework. They were asked to design a 10 min mini-class teaching session using content from their own discipline or other area of interest and utilizing the requisite technology to demonstrate its application to their teaching. They were encouraged to visit the technology training room for additional hands-on technology experience and to work individually with the IT team member to develop their teaching session. The second 2-h session then focused on the delivery of these various mini-classes to their peers. This design created opportunities for faculty to experience teaching techniques and strategies employed by colleagues from other disciplines and to offer formative feedback to each other on what they had observed and experienced during each of the mini-class presentations. A syllabus for each of the two 2-h sessions is shown in Table 2.

Table 2
Syllabus for training sessions.

Time	Activity	Technology used
Session A Goal Introduce technology in pedagogical context		
	Pre-reading with collaborative commentary	GoogleDocs
15 min	Sign in on SMART Board	SMART Board, laptops
15 min	Ice breaker	CopyCam
	Have teams make up list of "one thing no one knows about me" on whiteboard	
	Instructor demo CopyCam	
	All students go to web site and down load output from CopyCam	
30 min	Using pre-reading, have groups discuss the articles. Each team should identify strength, weakness and something this could try.	Elmo presenter
	Make team list on paper	
	Instructor teach one team how to use Elmo	
	Presenter, team then presents OTHER teams findings on Elmo presenter	
30 min	15 min: instructor presentation using SMART Board on Seven Principles	SMART Board
	Leave sections for participant ideas on how they are currently using each method, ask trainees to write their ideas during the presentation.	
	15 min: teams choose one of the Seven Principles and develop a list of ways to accomplish, one team adds their information to the PowerPoint using the SMART Board	
	Instructor demos how to capture this information	
30 min	Using the annotated list from previous exercise, have class add to the list, choose a participant or have individuals come up and write their additions. Encourage discussion, sharing	Sympodium
15 min	Wrap up	GoogleDocs
	Remind students of homework assignments	
	Put faculty into teams of two; have them agree on the technology they will use and act as support during demo in Session B	
Session B		
15 min	Have teams solve a riddle, fastest team to solve and put solution up on SMART board receives reward	SMART Board
10 min	Instructor prepare class for mini-class teaching sessions	GoogleDocs
	Use GoogleDocs for feedback on each participant presentation. Encourage faculty to assist each other. Try to make this close to classroom experience, but with support	
90 min (10 min each)	Faculty mini-class teaching sessions	Participant choice but must demo use of at least one technology
15 min	Wrap up	
	Evaluation surveys of training	

7.3. Data collection

Prior to the training sessions, the trainers developed a pre- and post-survey that indicated what technology knowledge and skill levels and experiences the faculty had prior to entering the training compared to their level following training completion. These surveys are shown in Tables 3 and 4. Because there was no initial plan to publish this training model, the pre- and post-surveys were not as consistent as they could have been had there been an earlier decision to widely share this training model. The decision to publish our successful experiences with this

Table 3
Technology pre-training survey.

1. Have you ever heard of constructivist or student centered learning pedagogy?					
Yes		68.1%			49
No		31.0%			23
2. Are you scheduled to use the upgraded classrooms in the fall?					
Yes		47.9%			34
No		52.1%			37
		No. exp.	Used a few times		Use regularly
3. Rate your level of experience with the following technology:					
Interactive whiteboard		90.4% (66)	8.2%		1.4%
Interactive whiteboard software		93.2% (68)	6.8%		0%
Sympodium		80.6%	12.5%		6.9%
Elmo/Dukane visual presenter		58.9% (43)	28.8%		12.3%
CopyCam		91.8% (67)	6.8%		1.4%
GoogleDocs		87.7% (64)	8.2%		4.1%
	0–20	21–40	41–60	61–80	81–100
4. In what percentage of your courses do you use the following technologies?					
Interactive whiteboard	98.5%	0	0	0	1.5%
Whiteboard software	100	0	0	0	0
Sympodium	84.1	4.3	2.9	1.4	7.2
Elmo/Dukane	78.3	11.6	7.2	1.4	1.4
CopyCam	98.6	0	0	1.4	0
GoogleDocs	95.7	2.9	0	1.4	0

Table 4
Technology post-training survey.

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	Response count
1. *I better understand how to use the following technology:*						
Interactive whiteboard	0.0% (0)	0.0% (0)	0.0% (0)	52.5% (31)	47.5% (28)	59
Interactive whiteboard software	0.0% (0)	0.0% (0)	5.1% (3)	67.8% (40)	27.1% (16)	59
Sympodium	1.7% (1)	0.0% (0)	6.9% (4)	70.7% (41)	20.7% (12)	58
Elmo/Dukane visual presenter	0.0% (0)	0.0% (0)	8.8% (5)	56.1% (32)	35.1% (20)	57
CopyCam	0.0% (0)	3.4% (2)	8.6% (5)	74.1% (43)	13.8% (8)	58
GoogleDocs	5.3% (3)	14.0% (8)	29.8% (17)	42.1% (24)	8.8% (5)	57
2. *I would feel comfortable using the following technology in my classroom:*						
Interactive whiteboard	0.0% (0)	3.4% (2)	10.2% (6)	44.1% (26)	42.4% (25)	59
Interactive whiteboard software	0.0% (0)	3.4% (2)	16.9% (10)	49.2% (29)	30.5% (18)	59
Sympodium	0.0% (0)	1.7% (1)	11.9% (7)	55.9% (33)	30.5% (18)	59
Elmo/Dukane visual presenter	0.0% (0)	1.7% (1)	8.5% (5)	50.8% (30)	39.0% (23)	59
CopyCam	0.0% (0)	3.4% (2)	25.4% (15)	49.2% (29)	22.0% (13)	59
GoogleDocs	5.3% (3)	17.5% (10)	43.9% (25)	21.1% (12)	12.3% (7)	57

	Percent	Count
3. *I would be interested in attending follow-up training for the following technology (check all that apply)*		
Interactive whiteboard (1)	66.7	26
Interactive whiteboard software (2)	61.5	24
Sympodium (3)	53.9	21
Elmo/Dukane visual presenter (5)	23.1	9
CopyCam (6)	20.5	8
GoogleDocs (3)	53.9	21
4. *How effective was your training at giving you a basic understanding of the new technology?*		
Very ineffective	5.1%	3
Ineffective	0.0%	0
Undecided	3.4%	2
Effective	49.2%	29
Very effective	42.4%	25
5. *Did the pedagogy discussions add to the training and make it interesting?*		
Yes	91.4%	53
No	8.6%	5
6. *Would you attend future sessions with pedagogy/technology together?*		
Yes	93.1%	54
No	6.9%	4
7. *Would you prefer to simply learn about the technology?*		
Yes	37.9%	22
No	62.1%	36
8. *Did the homework help you understand the applications?*		
Yes	84.5%	49
No	15.5%	9
9. *Did the pre-reading help your understanding of the reasons for the new technology?*		
Yes	54.4%	31
No	45.6%	26

training model came after the post-survey results were analyzed revealing that we had created a highly effective and collaborative technology training model for Butler University faculty.

8. Results and discussion

Eighty-eight faculty completed session one and 83 completed both sessions one and two of the training workshop representing 27% of the full-time faculty at Butler University. Of these trainees, 73 people (83% response rate) completed the pre-training survey that focused on the faculty's familiarity with the technology and constructivist teaching. Fifty-nine faculty (71% response rate) completed the post-training survey at the end of the two-session workshop which focused on faculty attainment of specific technology knowledge and skill outcome goals.

We were encouraged to learn from the pre-training survey that about two-thirds of our faculty trainees were familiar with constructivist teaching (Table 3). This gave us confidence that using constructivist pedagogy as the vehicle for technology training had the potential for achieving our training goals. We were not surprised to learn that less than 10% of Butler faculty routinely used interactive whiteboards in their teaching since this technology is not routinely a part of our technology mediated classrooms. Slightly more than a third of our faculty indicated that they had used or regularly used visual presenters to support their instruction. Again this was not a surprising finding since visual presenters are a standard part of the technology installation for a Butler University mediated classroom. Of those technologies addressed by our training, visual presenter use was reported to have the greatest use frequency by our faculty trainees. About 12% of faculty trainees reported that they had used or regularly used GoogleDocs. We believe the unexpectedly high amount of faculty use of this relatively new, web-based technology to support student collaboration may reflect specific faculty development efforts for this technology by one of our colleges over the previous year.

Slightly more than two-thirds (71%) of our faculty trainees completed the two-session training series and the post-training survey. Of greatest importance, 91% of the post-training survey respondents indicated that they felt the training was either effective or very effective in developing their basic understanding of the targeted technologies, and 91% also indicated that they felt the pedagogical context of the technology training added to the training experience and made it interesting. When asked if they would attend future technology training sessions done in a pedagogical context, 93% indicated that they would and only 38% indicated they would prefer to learn about technology in the absence of pedagogy. We were further gratified by the training respondents when 84% of them said that they believed their mini-class homework assignment helped them better understand the application of technology to their teaching. With regard to our goal of improving the technology use skills of our trainees, between 87% and 99% either agreed or strongly agreed that they better understood how to use the SMART™ interactive whiteboard, Sympodium™, visual presenters and CopyCam™ and a similar percent indicated they agreed/strongly agreed that they would be comfortable using these hardware technologies in their classroom.

With regard to our outcome goals (Table 1) relating to the web-based collaboration tool GoogleDocs, about 51% of post-training survey respondents indicated that they agreed/strongly agreed that they understood how to use this technology. However, only 33% agreed/strongly agreed that they felt comfortable using this technology in their classroom. Since 54% of respondents indicated they would be interested in attending additional training on GoogleDocs, we do not believe the modest level of comfort with this software indicated a lack of faculty interest but rather insufficient opportunity to work with it in a hands-on learning environment. Should it become a future goal to develop a higher level of faculty comfort and expertise with this web-based collaboration tool, we believe that our multidisciplinary, collaborative training model using a pedagogical context for knowledge and skill development would be a successful training strategy.

9. Conclusions

Despite the fact that many of the faculty in our trainee group had been taught by standard classroom methods where the faculty member was the "sage on the stage" and reading and homework assignments were routinely given, the faculty trainees admitted to having learned very little from their own out-of-class reading during their various collegiate experiences. The high rates reported by our trainees for knowledge and skill acquisition using this project model and their willingness to use constructivist methods and technology in the classroom are a dramatic demonstration of the effectiveness of these methods and the techniques applied in these training sessions. In addition, the learning outcomes developed prior to the training sessions were an excellent way to focus the trainers on the requirements of the training without insisting on standardized classroom teaching plans and strategies. The trainers were allowed to use their own individual strengths, strategies and teaching methods which resulted in their exhibiting more confidence and greater satisfaction with their classroom teaching experience. This resulted in better teaching and engagement of the trainers with the faculty.

The second of the two training sessions was used as a way to verify that the project learning outcomes had been met since each faculty trainee was required to demonstrate their learning in a 10 min topic-of-interest presentation to the entire class. Thus the trainers were able to assess first hand that their students had indeed achieved their learning goals.

This interdisciplinary, collaborative training model in which technology training is done in a pedagogical context enhanced the technology skills of 27% of the university faculty over a three month period while at the same time encouraging and modeling a more constructivist approach to teaching in a technology rich learning environment. The IR member in the classroom was not only an instructional resource for both the trainers and the faculty trainees but they also altered the faculty perception of the IR group on our campus. This experience enhanced their view that a partnership with the various colleges and faculty members was far more effective than what had been the primarily "service-oriented" focus of our IR department.

Over the course of the training project, new activities emerged that reflected this change in attitude such as collaborative faculty–IR development teams becoming the norm rather than the exception. One example was a "new innovations" team of faculty that met several times with IR representatives. Faculty views of the role of IR changed in this process as well. The view that IR was only responsible for the successful installation of technology was altered to a view that IR was responsible for the successful design, implementation and installation of technology as well as for continued faculty development. This important change in perception by both faculty and IR was demonstrated when classes began following this collaborative faculty training project which had been conducted the previous summer. The IR group installed an IR hotline for all faculty using the new technologies. They went on 18 h standby to ensure that any issue with the technology would be resolved within minutes to encourage faculty to use the technology with confidence. This created more of an IR presence for the faculty and the impression that IR was interested in rapid resolution of technology problems to ensure high quality education for the students.

Finally, the operations team that had previously viewed classrooms only as square-footage that they were responsible for building was transformed into an IR/faculty partnership. When the need for new computer laboratories arose, a team of faculty and IR and the construction manager was formed resulting in a design of the laboratory as a group effort. In 2008, these laboratories were installed and opened and the level of satisfaction among faculty and IR remains extremely high.

In conclusion, the team believes these efforts have transformed the way in which this university approaches the interrelated tasks of learning space design, pedagogical development and technology training. Partially by design and partially by experimentation and serendipity, the trainer team developed a faculty training model that is both highly successful and unique to Butler University but that can be also a framework or model for other universities as they seek ways to develop and implement effective technology training. This was verified by the survey results and it is hoped that future efforts at our institution can build upon this model and further document the effectiveness of these methods.

References

Britten, J., & Craig, P. (2006). Developing contextualized faculty training: Faculty development to support university-wide digital portfolio initiatives. *College Quarterly, 9*(2). Available from http://www.senecac.on.ca.

Brown, K. (2008). Plan and deliver: For technology to really work in the classroom, professional development is the key. *Technology and Learning, 28*(9), 34–41.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *American Association for Higher Education, 39*(7), 3–7.

Chuang, H., Thompson, A., & Schmidt, D. (2003). Faculty technology mentoring programs: Major trends in the literature. *Journal of Computing in Teacher Education, 19*, 101–106.

Epper, R., & Bates, A. (2001). *Teaching faculty how to use technology: Best practices from leading institutions*. Westport, CT: American Council on Education/Oryx Press.

Green, M. (2006). *The 2006 national survey of information technology in U.S. higher education*. Claremont, CA: The Campus Computing Project.

Guernsey, L. (2005). Teach in many locations at once: 5 professors connect using internet video. *Chronicle of Higher Education, 41*(42), B12.

Guernsey, L., & Young, J. (1997). As use of computers surges, colleges scramble to provide technical support. *Chronicle of Higher Education, 44*(2), A35.
Howe, N., Strauss, W., & Matson, R. J. (2000). *Millennials rising: The next great generation*. New York: Vintage Books.
Huang, G. (2004). China's clever classroom. *Technology Review, 26*.
Keengwe, J. (2007). Faculty integration of technology into instruction and students' perceptions of computer technology to improve student learning. *Journal of Information Technology in Education, 6*, 169–180.
Kheiry, M., & Britten, J. (2007). *Project Connect Final Report*. Submitted to the Chief Information Officer, Provost, Deans, and Faculty on behalf of the Instructional Technology group in the Butler University Information Resources unit.
McGlynn, A. (2005). Teaching millennials, our newest cultural cohort. *Education Digest, 71*(4), 12–16.
Molenda, M., & Sullivan, M. (2000). Issues and trends in instructional technology. *Educational Media and Technology Yearbook, 25*, 3–18.
Oblinger, D. (2005). Learning, learners and technology. *EDUCAUSE Review, 40*(5), 66–75.
Oblinger, D., & Oblinger, J. (Eds.). (2005). *Educating the Net generation*. Available at <http://www.educause.edu/educatingthenetgen/>.
Oblinger, D. (2008). Growing up with Google: What it means to education. *Becta Research Report, Emerging Technologies for Learning, 3*, 11–29.
O'Donnell, J. (2001). To youth camp, a long farewell. *EDUCAUSE Review, 36*(6), 14–19.
Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1–6. Available at <http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>.
Skiba, D., & Barton, A. (2006). Adapting your teaching to accommodate the net generation of learners. *Online Journal of Issues in Nursing, 11*(2), 15–25.
Sprague, D. (2004). Technology and teacher education: Are we talking to ourselves. *Contemporary Issues in Technology and Teacher Education, 3*(4), 353–361.
Strauss, W. (2001). The millennials come to campus. *About Campus, 6*(3), 6–7.
Strommen, E. F., & Lincoln, B. (1992). Constructivism, technology, and the future of classroom learning. *Education and Urban Society, 24*(4), 466–476.
Tapscott, D. (1998). *Growing up digital – The rise of the net generation*. New York: McGraw-Hill.
Tenofsky, D. (2005). Teaching to the whole student: Building best practices for collaboration between libraries and student services. *Research Strategies, 20*(4), 284–299. Available at <http://dx.doi.org/10.1016/j.resstr.2006.12.023>.
Tucker, P. (2006). Teaching the millennial generation. *Futurist, 40*(3), 7–17.