

Teacher Learner-Centered Beliefs and Concerns Regarding Instructional Technology

In an era steeped with deep concern for the downward tumbling performance of students in the United States on the international academic playing field and in the work place after graduation, means of facilitating learning environments that promote greater student success both within and beyond the classroom are sorely needed. One tool that has been repeatedly shown to promote these desirable outcomes is instructional technology (Becker & Ravitz, 1999; McCombs, 2000; Zhao & Cziko, 2001). However, reports continue to describe a lack of use or a lack of meaningful use of technology in elementary and secondary schools (McCombs, 2000; Rakes, Fields & Cox, 2006). This information is troubling in light of considerable investments of time and money on the part of federal, state, and local schools officials for more than two decades.

Two decades ago, computer-based technologies were welcomed as tools that would transform American classrooms. By 2000, Cuban and others declared that computers were “oversold and underused,” asserting that while progress had been made in making computers available in schools, teachers were not using computers at all or were not using them effectively. Recent surveys of teachers show some progress has been made, but also demonstrate how far schools still have to go before technology is truly an integrated part of the school experience. This gap becomes more troublesome every day as student use of technology outside the classroom grows much faster than their use of technology inside the classroom. In fact research indicates that as computer use in businesses and homes across the United States is becoming more pervasive, less than half of teachers use computers at all (Cuban, 2001).

The literature recounts a number of factors that impede teachers' use of technology. Among some of the more widely reported obstacles to the use of technology in the classroom are a lack of adequate training, technical and administrative support, and systemic incentives, as well as more traditional pedagogical beliefs (Zhao & Cziko, 2001). Researchers have attempted to identify the reasons for this phenomenon with little practical effect.

Many believe that one of the most important barriers is a lack of meaningful professional development for teachers. These discussions typically surround the skills and application opportunities that teachers need. Increasingly, graduates of teacher education programs possess basic technology skills, but may not truly understand exactly how to apply technology in meaningful ways (Charp, 2003).

Other researchers have viewed the barriers to technology implementation from the psychological perspective of implementing school change. Attention has been paid to several cognitive and affective constructs that may affect teachers' willingness to adopt the use of instructional technology. Both cognitive and affective factors influence an individual's future behavior. In this study, the cognitive construct of teacher beliefs about teaching and learning as well as the affective construct of teacher concerns related to technology innovations were investigated. Both factors are trainable characteristics that can be used as a basis for the development of effective professional development activities that promote teacher to effective use of technology in the classroom.

Teacher Beliefs

Teacher Beliefs. Beliefs play an integral role in predicting human behavior (Bandura, 1986, 1997). Fishbein and Ajzen (1975) define beliefs as perceptions of

information concerning an object or an idea. A better understanding of teachers' beliefs that inform their resistance to implement technology use in the classroom may help in the development of professional training that addresses teachers' uneasiness and resistance related to instructional technology (Calderhead, 1996).

Simply put, beliefs are typically either the catalyst for or impediment against individuals' engagement in specific behaviors, such as technology use (Ajzen, 2002). For example, if a teacher does not believe that technology facilitates student learning, he or she will probably not integrate technology in the classroom. Furthermore, if a teacher believes that more traditional modalities of instruction, such as direct lecture, are more effective they are unlikely to use technology in the classroom.

In general, beliefs lead to action. However, in one three-year study (Simmons, et al., 1999), researchers found that teachers described their instructional practices as very learner-centered. Observations of these teaching practices starkly contrasted with their beliefs. While teachers professed learner-centered beliefs, they behaved in teacher-centered ways. Davis, Konopak, and Readence (1993) suggest that the challenges of classroom teaching often constrain teachers' ability to teach in ways that are aligned with their beliefs. Despite teachers' stated beliefs, this study suggests that teachers' actions are significantly influenced by classroom contexts.

This dissonance between beliefs and actions could also result from the fact that what teachers believe is best in theory (e.g. learner-centered education is best) does not always translate into actions when faced with the reality of actually having to change their practice in order to implement those beliefs. Their concerns about what will happen

when they are asked to actually implement an action may contribute to a disconnect between their beliefs and their actions in the classrooms.

There is some evidence that the lack of technology use by teachers might be related to a fundamental conflict between teacher beliefs about the nature of teaching and learning and teacher perceptions about the degree to which technology use is compatible with those beliefs. For example, Norton, McRobbie, and Cooper's (2000) study of mathematics teachers in a technology-rich school who did not use technology as a regular part of their instructional practices showed the deep roots of teachers' transmission-oriented beliefs about content and instruction. They found that "resources were not used because the pedagogy, which was implicit in the activities contained in these resources, did not support the teacher's preferred teaching strategies" (p. 105).

Other studies directly link effective implementation of instructional technology to teachers' beliefs about the nature of teaching and learning. Fulton (1999) conducted a case study involving 36 middle school teachers. Results suggested that technology use of teachers did match their teaching beliefs. Teachers with constructivist teaching beliefs used technology for a learner-centered teaching style, while those with more traditional (non-constructivist) teaching beliefs used technology in a more teacher-centered style. Other studies have resulted in similar findings (Becker & Ravitz, 1999; Dills, 2004; Dwyer, 1994; Kent & McNergney, 1999; Rakes, Fields, & Cox, 2006; Rakes, Flowers, Casey, & Santana, 1999; Sandholtz, Ringstaff, & Dwyer, 1997). For example, Becker and Ravitz (2001) found that

. . . teachers who avoid computers are also the ones who seem to be most "traditional" in their teaching philosophy; teachers who believe that their role is to transmit to students an externally mandated curriculum by means of a highly controlled pedagogy. In contrast, teachers who value students doing group

projects and working on topics of personal interest—an approach compatible with belief in constructivist learning principles—are among the most frequent computer-using teachers (pp. 9-10).

Learner-Centered Beliefs. One specific perspective on teaching and learning relates to a view of whether classrooms should be teacher-centered or learner-centered. The American Psychological Association's (APA, 1997) 14 learner-centered principles provide the theoretical framework for learner-centered education (see Appendix A). The 14 learner-centered principles represent a synthesis of decades worth of literature about the learning process. These principles are meant to serve as practical guideposts for every day teaching practice and as a framework for educational reform. Furthermore, the principles represent a pedagogical orientation in which the teacher becomes a facilitator of learning instead of a disseminator of facts (McCombs & Whisler, 1997).

More recently, technology has been viewed as a tools that can facilitate higher-order thinking and reasoning skills among students and, therefore, as more of a learner-centered tool. For example, McCombs (2000) and Bransford, Brown, and Cocking (1999) have discussed links between learner-centered education and technology.

Teacher Concerns

Concerns are an individual's set of feelings, perceptions, preoccupations, thoughts, considerations, motivations, satisfactions, and frustrations related to a target innovation. Concerns towards an object or idea have been linked to individual's willingness to adopt classroom innovations. For example, one's concerns about his or her personal ability to implement an instructional practice may set up a contradiction that inhibits the individual from acting on positive beliefs about that instructional practice (George, Hall, & Stiegelbauer, 2006; Hall, George & Rutherford, 1979).

Research regarding concerns is rooted in change theory. Within this literature, two innovation diffusion models are frequently used to describe teachers' concerns related to the adoption of classroom innovations: Rogers' Diffusion Model and the Concerns Based Adoption Model. Both of these models serve as conceptual frameworks that can describe, explain, and predict behavior. Rogers (1983) described diffusion as a sequential process through which some type of innovation is communicated over time among members of a social system. He promoted a five-stage progression of concerns including knowledge, persuasion, decision, implementation, and confirmation. Building upon Rogers' model, Hall and Hord (1987) later developed the Concerns Based Adoption Model.

Concerns Based Adoption Model (CBAM)

The CBAM is an empirically based conceptual framework that describes, explains, and predicts probable teacher behavior as he or she implements an innovation and participates in developmental activities. The framework consists of three main diagnostic dimensions: Stages of Concern, Levels of Use, and Innovation Configuration (Hall, Hord, Stiegelbauer, & Dirksen, 2006).

Stages of Concern. The Stages of Concern (SoC) dimension of the CBAM model describes concerns related to one's experience with or perception of the innovation. This portion of the model analyzes one's feelings, observations, problems, successes, and failures while learning about an innovation and progressing through the change process related to adopting an innovation. The Stages of Concern Questionnaire (SoCQ) was developed as a tool for identifying the intensity of teacher concerns about such innovations such as technology innovations (George, Hall, & Stiegelbauer, 2006). The

information provided by the SoCQ helps to identify an individual's willingness to adopt and use an innovation (Scott, 1998).

Stages of Concern Questionnaire. The SoCQ consists of seven stages of concern that fall in the three categories of self, task, and impact concerns (Hall & Hord, 1987; Hord & Huling-Austin, 1986). Self concerns include the first three stages: Awareness, Informational, and Personal. In Stage 0 (Awareness), the individual's concerns may be unrelated to the innovation. The individual may be unaware of the innovation, or the teacher may be aware of, but unconcerned with the innovation. In Stage 1 (Informational), the individual expresses general awareness of and interest in the innovation. In Stage 2 (Personal), the individual expresses concerns about how the innovation will affect him or her and manifests concerns related to personal ability, adequacy, demands, and role.

Task concerns include one level of concern. In Stage 3 (Management), the individual expresses concerns about a task such as logistics and efficient resource use. The more mature or impact concerns include three stages. In Stage 4 (Consequence), the individual expresses concerns related to student outcomes. In Stage 5 (Collaboration), the individual expresses concerns related to working with others in order to implement the innovation. In Stage 6 (Refocusing), the individual expresses concerns about modifying or improving the innovation and assisting others use of the innovation. A summary of the seven stages is presented in Table 1 below. A summary of the stages is presented in Table 1 below.

Table 1

Stages of Concern Summary

Stage of Concern	Expression of Concern
6. Refocusing	I have some ideas about something that would work even better. Is there a better way? (proactive)
5. Collaboration	How can I relate what I am doing to what others are doing? How do others do this? What is the maximum potential of doing this?
4. Consequence	How is my use of the innovation affecting learners? How can I refine it to have more of an impact?
3. Management	How can I fit it all in? How can I master this? I seem to be spending all of my time getting materials ready.
2. Personal	How will using this innovation affect or impact me? What is my role in this?
1. Informational	How does this work? I would like to know more about it.
0. Awareness (reactive)	What is it? I am not really concerned about it.

The SoCQ has been widely used in the literature to investigate teacher attitudes and feelings regarding educational reform innovations. Moreover, it has been used frequently to analyze teachers' concerns about the use of technology. The true value of the SoCQ is that it not only provides a glimpse of an individual or group's internal

affective experience, but that it is also prescriptive. In other words, the SoCQ identifies concerns and identifies interventions to address those concerns (Hord, et al., 2005).

Summary

Beliefs and concerns can be used to predict behavior (Ajzen, 2002). What is less clear is the impact of certain specific beliefs, such as learner-centered beliefs about teaching and learning, and concerns regarding one's ability to implement specific practices such as technology integration. Together, these variables may be a powerful influence on teacher behavior. The lack of more than superficial technology use on the part of many teachers may be related to a fundamental conflict between teacher beliefs about the nature of teaching and learning and teacher perceptions about the ways technology use fits into their beliefs along with their concerns about the consequences of implementing technology use in their classrooms.

Research Question

Is there a difference in teacher concerns about the use of instructional technology, particularly their concerns about the effect of the use of instructional technology on students, based on their learner-centered beliefs?

Methodology

In order to measure concerns about technology and learner-centered beliefs, participants completed the Stages of Concern Questionnaire (SoCQ), the Teacher Beliefs Survey (TBS) and provided basic demographic information. The questionnaire was prepared for presentation on the Internet using Dragon, survey software that is a companion to the FileMaker Pro database software. This software will not allow participants to submit incomplete data, directing them to missing responses before

allowing submission. No personal information was collected. All responses will be voluntary and anonymous. Participants were invited to participate via email and asked to complete the questionnaire

The convenience sample for this study consisted of 66 graduate students enrolled in a masters program in education at the University of Tennessee at Martin. All subjects were employed as teachers in grades 5-12.

Instruments

This study used two survey instruments to explore relationships among teacher beliefs about teaching and learning in addition to concerns regarding learner-centered practices. The first was the Teacher Beliefs Survey (McCombs & Lauer, 1997). The second was the Stages of Concern Questionnaire (SoCQ) (George, Hall, & Stiegelbauer (2006).

Teacher Beliefs Survey

The TBS was specifically designed to measure 5th –12th grade teachers' learner-centered beliefs. The TBS is based on APA's 14 learner-centered psychological principles (see Appendix A) (APA, 1997), and employs a four point Likert scale consisting of 35 statements (see Appendix B). Respondents respond to each of the 35 statements based on the extent to which they agree or disagree with each item (McCombs & Whisler, 1997). Responses load on one of three different factors: learner-centered beliefs about learners, learning, and teaching, nonlearner-centered beliefs about learners, and nonlearner-centered beliefs about learning and teaching (McCombs & Whisler, 1997).

The 14 learner-centered principles also provide the foundation for the definition of

these three factors. An example of a learner-centered beliefs statement is: *Students have more respect for teachers they see and can relate to as real people, not just teachers.* An example of a nonlearner-centered belief about learners statement is: *There are some students whose personal lives are so dysfunctional that they simply do not have the capability to learn.* Finally, an example of a nonlearner-centered belief about learning and teaching statement is: *I can't allow myself to make mistakes with my students.*

To score the TBS, the averages of the scores for each subsection determined whether the respondent was more learner-centered or non-learner-centered on that factor. If an individual's average for factor 1—learner-centered beliefs about learners, learning, and teaching—is above 3.4 the respondent is considered more learner-centered (McCombs & Whisler, 1997). An average below 2.0 on factor 1 indicates the individual is more non-learner-centered. For factor 2—non-learner-centered beliefs about learning and teaching—an average above 2.4 indicates the individual is more non-learner-centered, and an average below 2.0 indicates a more learner-centered orientation.

For factor 3—non-learner-centered beliefs about learners—an average above 2.4 indicates the respondent is more non-learner-centered, and an average below 2.0 indicates a more learner-centered orientation. Scores falling between the upper and lower parameters indicate that the respondent is neither learner-centered or non-learner-centered on that factor. Essentially, these individuals hold both learner-centered and non-learner-centered beliefs, but do not present a more polarized orientation in either direction.

It is also possible that the same respondent may be scored as being learner-centered on one factor and non-learner-centered on another. In such cases, an overall

determination can be made if the scores on two of the three factors indicate the same categorization. A respondent who scores as neutral on two of the three factors would be considered neutral overall.

Each respondent's belief profile was determined according to these parameters, and each respondent was identified as learner-centered, neutral, or non-learner-centered for each of the three factors. Because it is possible when using the scoring parameters to find cases in which a respondent is designated as learner-centered on one factor but non-learner-centered on the other factors, or vice versa, the overall learner-centeredness designation was determined by noting whether a respondent did or did not have two similar designations among the three factors. In other words, if a respondent scored as learner-centered or neutral on one factor but non-learner-centered on the other two factors, the respondent was designated a non-learner-centered respondent. For cases in which a respondent was learner-centered on one factor, non-learner-centered on another factor, and neutral on the third factor, a designation of neutral overall was given.

In order to demonstrate clear differences between learner-centered and non-learner-centered respondent, neutral respondents were excluded from the analysis of differences between learner-centered and non-learner-centered instructors regarding concerns related to the use of technology innovations.

Stages of Concern Questionnaire

The SoCQ is the most widely used and rigorous assessment of concerns (Hall & Hord, 2001). The SoCQ identifies the intensity of the seven stages of concern related to the adoption of an innovation (Hall, George, & Rutherford, 1986). The questionnaire is a 35-item Likert scale developed using K-12 and university instructors. Each of the seven

Stages has five statements to which the respondents indicate their degree of concern based on an 8-point scale. The statements were selected to represent varying types of concerns that preservice and inservice teachers have when they are initially introduced to an educational innovation, begin to use it, and then move to more seasoned and mature perspectives along with increased confidence in the use of the innovation (Negrete, 2004).

The SoCQ was originally validated in 1979 on a group of teachers involved in team teaching and professors concerned about innovation ($n=830$) and a sub sample ($n=132$) of this group that participated in a test-retest of the instrument over a two-week period (Hall, George, & Rutherford, 1979). Cronbach's alpha was used to establish internal reliability, alpha coefficients ranged from .64 to .83. The test-retest sub sample correlation ranged from .65 to .84, indicating the internal consistency and stability for each of the seven Stages (Hall et al, 1979). The SoCQ has been further validated in a number of studies over the course of the last two decades (James & Lamb, 2000; Rakes & Casey 2002; van den Berg, 1993).

Each respondent was assigned a raw score for each level of the stages of concern—Awareness (Stage 0), Informational (Stage 1), Personal (Stage 2), Management (Stage 3), Consequence (Stage 4), Collaboration (Stage 5), and Refocusing (Stage 6). Using the mean score for each item, percentiles for each level of concern were computed, graphed, and analyzed to create a profile for the group that illustrates the relative intensity of each stage of concern (George, Hall, & Stiegelbauer, 2006).

Results

Research Question. Is there a difference in teacher concerns about the use of instructional technology, particularly their concerns about the effect of the use of instructional technology on students, based on their learner-centered beliefs?

Respondent Demographics. Sixty-six usable surveys were returned. Approximately 65 percent of respondents were classified as non-learner-centered (n = 43), 11 percent of respondents were learner-centered (n = 7), and 24 percent of respondents were neutral (n = 16). Table 2 provides a summary of the relevant demographic information.

Table 2

Respondent Demographics

Variable	<i>n</i>	percent
Learner-Centered Beliefs		
Learner-Centered	7	10.6
Non-Learner Centered	43	65.2
Neutral	16	24.2
Grade Taught		
5-6	14	21.2
Middle School	14	21.2
7-9	5	7.6
7-12	14	21.2
10-12	19	28.8

(table continues)

Variable	<i>n</i>	percent
Highest Degree Earned		
Bachelors	48	72.7
Masters	16	24.2
+30 hours	1	1.5
Doctorate	1	1.5
School Location		
Urban	1	1.5
Rural	57	86.4
Suburban	8	12.1
School Size		
Under 100	1	1.5
101-500	30	45.5
501-1000	19	38.8
Over 1000	66	24.2
Years Teaching Experience		
1 - 5 years	43	65.1
6 - 10 years	10	15.2
11 - 15 years	5	7.6
16 - 23 years	8	12.1
Primary Subject Taught		
Self-Contained Classroom	2	3.0
Language Arts	10	15.2
Social Studies	7	10.6
Science	15	22.7
Math	17	25.8
Fine Arts	5	7.6
Physical Education	3	4.5
Special Education	2	3.0
Foreign Language	2	3.0
Computer Science	1	1.5
Other	2	3.0

SoCQ Results. Percentiles for the total sample of respondents along with separate percentiles for both learner-centered and non-learner-centered respondents are shown in Table 3 below.

Table 3

Percentiles for the Stages of Concern Subscales

Stages of Concern	0	1	2	3	4	5	6
Percentile							
Learner-Centered (N=7)	91	95	91	94	48	84	94
Total Sample (N=66)	93	91	85	83	48	76	77
Non-Learner-Centered (N=43)	94	91	87	86	54	80	81

Typically, scores of a group represent the dominant high and low stages of concern for that group. Percentiles for each group are represented graphically in Figure 1.

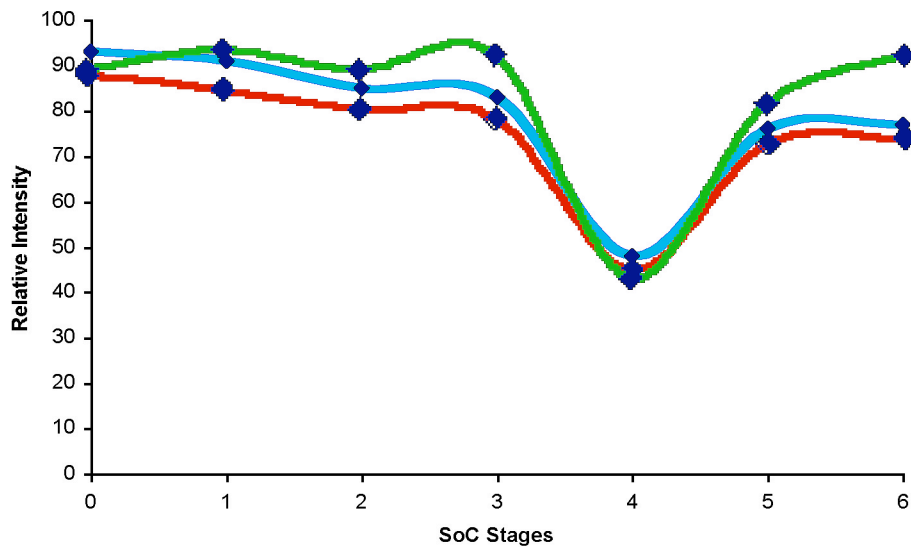


Figure 1. Stages of Concern Profile Comparison

Note. Top line (green) is a profile for learner-centered teachers only (n=43); middle line (blue) is a profile for all respondents (N=66); lower line (red) is a profile for non-learner-centered teachers only (n=7).

All three profiles are quite similar and referred to as non-user profiles, representations of teachers who have not yet truly begun to integrate technology into their teaching. Self-concerns (Stages 0 - Awareness, 1 - Informational, and 2 - Personal) were high and the impact concerns (Stages 4 – Consequence) regarding students were much lower (George, Hall, & Stiegelbauer, 2006). Stages 5 - Collaboration, and 6 - Refocusing were lower than self-concerns with the exception of the Stage 6 – Refocusing for the learner-centered respondents.

Analysis of Variance. Inservice teachers’ scores on the Teacher Beliefs Survey (TBS) were examined to determine if differences existed between learner-centered and non-learner-centered teachers’ scores on the Stages of Concern Questionnaire subscales. In order to examine the difference between teacher beliefs and their concerns regarding the effect of technology use on students, the data were analyzed Analysis of Variance (ANOVA) with Stages of Concern subscale scores entered as the dependent variables and the Teacher Belief Survey scores entered as the independent variable.

Table 4

Analysis of Variance

Stages of Concern		SS	df	MS	F	Sig.
Aware	Between Groups	46.22	1	46.22	1.56	.218
	Within Groups	1422.90	48	29.64		
	Total	1469.12	49			

(table continues)

Stages of Concern		SS	df	MS	F	Sig.
Inform	Between Groups	33.78	1	33.78	.97	.329
	Within Groups	1669.60	48	34.78		
	Total	1703.38	49			
Person	Between Groups	45.44	1	45.44	.780	.381
	Within Groups	2795.14	48	58.23		
	Total	2840.58	49			
Manage	Between Groups	66.05	1	66.05	1.53	.222
	Within Groups	2068.13	48	43.09		
	Total	2134.18	49			
Conseq	Between Groups	4.95	1	4.95	.12	.735
	Within Groups	2043.63	48	42.58		
	Total	2048.58	49			
Collab	Between Groups	12.80	1	12.80	.20	.659
	Within Groups	3111.61	48	64.82		
	Total	3124.42	49			
Refocus	Between Groups	104.65	1	104.65	2.32	.134
	Within Groups	2165.85	48	45.12		
	Total	2270.50	49			

Results (see Table 4) indicated no significant differences for any of the SoCQ subscales between learner-centered and non-learner-centered teachers in this sample.

Discussion

The purpose of the present study was to determine if there were differences in teacher concerns about the use of instructional technology, particularly their concerns about the effect of the use of instructional technology on students, based on their learner-centered beliefs. The primary limitation of any attempt to interpret the results of this

study lies in the small sample size with a particularly small sample of learner-centered respondents.

When comparing the SoCQ profile of the total sample, the learner-centered teachers, or the non-learner-centered teachers, the similarities are striking (see Figure 1). All profiles demonstrate high self-concerns (Stages 0, 1, 2, and 3) that must be addressed before those concerns can be resolved, allowing them to move forward and successfully make technology an integral part of their instructional practices.

It was hypothesized that learner-centered teachers would demonstrate significantly higher concerns about the impact of technology use on students. For this sample, strong self-concerns appeared to interfere with the ability of these teachers to act based on their beliefs about teaching and learning with regard to the use of technology.

The small tailing-up of the profile at Stage 6 (Refocusing) for the non-learner-centered teachers and the large tailing-up of Stage 6 for the learner-centered teachers is an interesting finding. Tailing up refers to a profile in which the intensity of Stage 6 (Refocusing) concerns is greater than the intensity of Stage 5 (Collaboration) concerns. This characteristic in a nonuser profile (George, Hall, & Stiegelbauer, 2006; Hall et al., 1986) indicates a resistance to the use of technology, a somewhat negative view of technology, or possibly a desire to redirect or modify the use of technology.

When Stage 6 tails up, it can be inferred that respondents have instructional ideas they see as having more importance than technology. “Any tailing up of the Stage 6 concerns on a non-user profile is a warning that the respondent(s) might be resistant to the innovation. A more severe tailing-up should be heeded as an alarm” (George, Hall, & Stiegelbauer, 2006, p. 42). The participants’ profile indicates that these teachers are not only uninformed about technology use, but they are also likely to undermine technology-

based reform efforts.

Implications

The results of this study are both surprising and challenging. Even with the small number of learner-centered teachers, the lack of differences in concerns regarding the use of technology and, in particular, its impact on students was unexpected. However, because higher self-concerns persist, these concerns may act as a barrier that prevents teachers from acting on their beliefs in actual classroom situations.

Beliefs can be influenced through persuasion. Although many people react strongly to the term “persuasion,” persuasion can be a useful metaphor for education and professional development. Persuasion suggests a framework in which professional development training encourages not only the acquisition of knowledge, but also the modification of pre-existing ideas through social interaction, deep processing and reflection, discourse, and critical analysis of arguments and evidence (Alexander, Fives, Buehl, & Mulhern, 2002; Buehl, Fives, Cox, & Manning, 2005; Sinatra & Kardash, 2004).

The Concerns-Based Adoption Model provides prescriptions for dealing with teacher concerns that can promote positive change. These concerns (Hord, et al., 2005) are presented as trainable characteristics through specific professional development interventions.

Future Research

The results present additional questions for future investigation. For example, each of the three groups, learner-centered, neutral, and non-learner-centered, reported high Awareness, Information, and Self Concerns, indicating that they not only need more information regarding technology, but that they are also concerned about the toll

implementing technology in the classroom will take. The fact that even the teachers that hold more learner-centered beliefs indicated that they need more information on the subject reflects how little training teachers receive to prepare them to effectively implement technology in the classroom.

Thus, future research should investigate the effect that provision of information related to educational technology and its implementation has on teachers' concerns related to technology. Moreover, future research should also investigate the effect that provision of technology training has on teachers self concerns. It is also important to note that the study was limited by the small sample size. In the future, the study should be replicated on a larger population.

The population of teachers who could not be defined as either learner-centered or non-learner-centered presents other opportunities for study. One challenge for future research is to explore more fully specific teacher beliefs that underlie their classroom behavior and relationship of these beliefs to technology use. It is important to further explore conflicts between what teachers believe about teaching and learning (e.g., learner-centered vs. teacher-centered) and how they choose to use or ignore technology in their classrooms. Resolution of such a conflict may prove to be one of the most important requirements for successful technology implementation (Zhao et al, 2002).

By identifying and addressing the specific concerns that teachers hold related to the use of technology in the classroom, professional development may move one step closer to facilitating the development of more learner-centered teachers who effectively implement learner-centered education in the classroom. Thus, future research should

continue to identify the specific concerns that teachers hold with regard to technology and assess the effectiveness of training units developed to address those concerns.

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APPENDIX A

Learner-Centered Psychological Principles¹

METACOGNITIVE AND COGNITIVE PRINCIPLES

Principle 1: Nature of the learning process.

The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience.

Principle 2: Goals of the learning process.

The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge.

Principle 3: Construction of knowledge.

The successful learner can link new information with existing knowledge in meaningful ways.

Principle 4: Strategic thinking

The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals.

Principle 5: Thinking about thinking

Higher order strategies for selecting and monitoring mental operations facilitate creative and critical thinking.

Principle 6: Context of learning

Learning is influenced by environmental factors, including culture, technology, and instructional practices.

MOTIVATIONAL AND AFFECTIVE PRINCIPLES

Principle 7: Motivational and emotional influences on learning

What and how much is learned is influenced by the learner's motivation. Motivation to learn, in turn, is influenced by the individual's emotional states, beliefs, interests and goals, and habits of thinking.

Principle 8: Intrinsic motivation to learn

The learner's creativity, higher order thinking, and natural curiosity all contribute to motivation to learn. Intrinsic motivation is stimulated by tasks of optimal novelty and difficulty, relevant to personal interests, and providing for personal choice and control.

Principle 9: Effects of motivation on effort

Acquisition of complex knowledge and skills requires extended learner effort and guided practice. Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion.

Learner-Centered Psychological Principles¹

DEVELOPMENTAL AND SOCIAL PRINCIPLES

Principle 10: Developmental influence on learning

As individuals develop, they encounter different opportunities and experience different constraints for learning. Learning is most effective when differential development within and across physical, intellectual, emotional, and social domains is taken into account.

Principle 11: Social influences on learning

Learning is influenced by social interactions, interpersonal relations, and communication with others.

INDIVIDUAL DIFFERENCES PRINCIPLES

Principle 12: Individual differences in learning

Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.

Principle 13: Learning and diversity

Learning is most effective when differences in learners' linguistic, cultural, and social backgrounds are taken into account.

Principle 14: Standards and assessment

Setting appropriately high and challenging standards and assessing the learner and learning progress—including diagnostic, process, and outcome assessment—are integral parts of the learning process.

¹ APA Work Group of the Board of Educational Affairs (1997, November). *Learner-centered psychological principles: A Framework for school reform and redesign*. Washington, DC: American Psychological Association.