Creating Technology-Enhanced, Learner-Centered Classrooms: K–12 Teachers' Beliefs, Perceptions, Barriers, and Support Needs

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Abstract

Although a wealth of literature discusses the factors that affect technology integration in general and how to improve professional development efforts, few studies have examined issues related to learner-centered technology integration. Thus, this study aims to explore K–12 teachers' beliefs, perceptions, barriers, and support needs in the context of creating technology-enhanced, learner-centered classrooms. The researcher used an online survey to collect data, and 126 teachers participated in the survey. The findings of this study provide practical insights into how to support teachers in creating technology-enhanced, learner-centered classrooms. This article discusses the implications for professional development and the need for paradigm change. (Keywords: Learner-centered instruction, technology integration, teacher beliefs, perceptions, barriers, support needs, teacher education, professional development, paradigm change)

Our information society needs people who can effectively manage and use ever-increasing amounts of information to solve complex problems and to make decisions in the face of uncertainty. There is little argument that the traditional factory model of education is incompatible with the evolving demands of the information age (Reigeluth, 1999b). The factory model also does not take into account students' varying needs, which leads to student dissatisfaction and demotivation. Students and parents often perceive school learning as irrelevant to their personal and real-life needs and interests.

The learner-centered model focuses on developing real-life skills, such as collaboration, higher-order thinking, and problem-solving skills, and better meets the complex needs of the information age. The learner-centered model also addresses the personal domain, which is often ignored in conventional schools and classrooms, and it results in increased student motivation and learning. In learner-centered classrooms, students feel accepted and supported, feel ownership over their learning, and are more likely to be involved and willing to learn (Bransford et al. 2000; Cornelius-White & Harbaugh, 2009; McCombs & Whisler, 1997; Reigeluth, 1994).

Research evidence on the effectiveness of learner-centered approaches continues to grow. Recently, Cheang (2009) examined the effects of learner-centered teaching on motivation and learning strategies in a third-year pharmacotherapy course in a doctor of pharmacy program. In the study, the students were asked to complete the Motivated Strategies for Learning Questionnaire (MSLQ) before and after taking the course. Students also assessed the extent to which the learner-centered approach facilitated their learning. Results show that students' intrinsic goal orientation, control of learning beliefs, self-efficacy, critical thinking, and metacognitive self-regulation significantly improved after taking the course. Students were also positive in their assessment of the learner-centered experience in the course. These results indicate that the learner-centered approach is effective in promoting several domains of motivation and learning strategies.

Using a qualitative metasynthesis approach, Strobel and van Barneveld (2009) compared and contrasted the findings of the meta-analytical research on the effectiveness of problem-based learning (PBL), one of the learner-centered approaches. Their results indicate that PBL is significantly more effective than traditional instruction when it comes to long-term knowledge retention, performance improvement, and satisfaction of students and teachers, whereas traditional approaches are more effective for short-term retention. These are just a few examples. Numerous studies provide evidence that students are motivated to learn and develop more in-depth understanding of content as well as real-world skills in learner-centered environments.

Today's students, often called digital natives or the Net Generation, grow up with technology. Most of them have never known life without the Internet. They have spent their entire lives using computers, cell phones, and other digital media and have integrated technology into almost everything they do. It is obvious that technology is an integral part of their lives (Oblinger, 2008; Prensky, 2007). To engage them in learning, there has been increased emphasis on the integration of technology into K–12 classrooms. Although a wealth of literature discusses technology integration in general, there is a lack of research on learner-centered technology integration. This study aims to explore K–12 teachers' beliefs, perceptions, barriers, and support needs in the context of creating technology-enhanced, learner-centered classrooms.

Learner-Centered Classrooms

The American Psychological Association (1993, 1997) identified 12 learner-centered psychological principles. The domains of the learner-centered principles—the metacognitive and cognitive, affective, personal and social, developmental, and individual

differences factors—emphasize both the learner and learning. McCombs and Whisler (1997) contend that the learner-centered perspective "focuses equally on the learner and learning" and that the ultimate goal of education is to foster the learning of all learners (p. 14). Learner-centered instruction (LCI) does not take only one form, but learner-centered classrooms tend to have the following general characteristics in common:

Personalized and customized learning. Learner-centered teachers have high expectations for all students and pay close attention to the knowledge, skills, and attitudes that each student brings into the classroom. Considering the unique and diverse needs and styles of the students, they include personally meaningful and relevant goals and provide personalized learning experience and support. They are also sensitive to cultural issues as well as individual differences. Students actively engage in learning and work at their own individual pace (Bransford et al., 2000; DiMartino, Clark, & Wolk, 2003; McCombs & Whisler, 1997; Reigeluth, 1994, 1999a; Reigeluth & Duffy, 2008).

Social and emotional support. Learner-centered teachers foster students' social and emotional growth as well as intellectual growth by creating a supportive and positive environment. They assume that all students want to learn and provide them with emotional support and encouragement. Students feel like they belong in the class (McCombs & Whisler, 1997; Reigeluth, 1999a).

Self-regulation. Learner-centered teachers serve as facilitators rather than transmitters of knowledge. They give students increasing responsibility for the learning process and provide an optimal amount of structure without being overly directive. They encourage students' participation and empower students by sharing power. They also help students develop metacognitive skills and learning strategies. Students are actively engaged in and take ownership of their learning (Cornelius-White & Harbaugh, 2009; McCombs & Whisler, 1997; Reigeluth, 1994, 1999a; Weimer, 2002).

Collaborative and authentic learning experiences. Learner-centered teachers provide students with authentic learning experiences that help students develop real-world skills, such as communication, collaboration, critical-thinking, creative-thinking, problem-solving, and decision-making skills. Students are encouraged to work collaboratively with others, to solve problems, and to create new knowledge rather than just recall or restate knowledge. Learning activities are often global, interdisciplinary, and integrated (Bransford et al., 2000; Cornelius-White & Harbaugh, 2009; McCombs & Whisler, 1997; Reigeluth, 1994).

Assessment for learning. Learner-centered teachers assess different students differently. They conduct assessments not just to generate grades but to promote learning. They monitor individual students' progress continually to provide feedback on their growth and progress. They also promote students' reflection on their growth as learners and help them develop self- and peer-assessment skills. What they assess is congruent with students' learning goals. Teachers make all assessments as authentic as possible (Bransford et al., 2000; McCombs & Whisler, 1997; Weimer, 2002).

It is worth noting that different learner-centered teachers have varying but overlapping beliefs and that any single learner-centered instruction will not necessarily include all of these attributes (McCombs & Whisler, 1997).

Technology Integration

Although there is no clear definition of technology integration in K–12 contexts (Bebell, Russell, & O'Dwyer, 2004), technology integration is generally viewed as the use of technology for instructional purposes. Mishra and Koehler (2006, 2008) introduced Technological, Pedagogical, and Content Knowledge (TPACK) as a framework for teacher knowledge for technology integration and argued that the development of TPACK is critical for effective technology integration. The TPACK framework builds on Shulman's (1986, 1987) idea of pedagogical content knowledge (PCK). As the name suggests, the framework has three main components: content, pedagogy, and technology. However, TPACK goes beyond these three components. Emphasizing the importance of dynamic relationships among these components, Mishra and Koehler (2006, 2008) identified pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPCK) in addition to content knowledge (CP), pedagogical knowledge (PK), and technological knowledge (TK). The TPACK framework shows that technology integration requires much more than technical skills.

Recognizing the importance of the links among technology, pedagogy, and content, researchers have examined ways to improve technology integration practices and professional development efforts. For instance, Ertmer et al. (2003) designed and implemented professional development activities to help teachers create problem-based learning environments that promote meaningful uses of technology within the learner-centered context. Brush and Saye (2009) provided preservice social studies teachers with opportunities to explore innovative, emerging technologies in authentic social studies learning and teaching situations. Kopcha (2010) presented a systems-based model of technology integration that uses mentoring and communities of practice to prepare teachers to integrate technology in more student-centered ways. Polly and Hannafin (2010) proposed a Learner-Centered Professional Development (LCPD) framework, which includes six major features. LCPD efforts are (a) focused on student learning, (b) teacher-owned, (c) intended to develop knowledge of content and pedagogies, (d) collaborative, (e) ongoing, and (f) reflective. Overall, research suggests that professional development efforts move their focus from building teachers' isolated technical skills to preparing teachers to implement technology-enhanced, learner-centered instruction.

Despite generally improved conditions for technology integration, including increased access to technology and increased training for teachers, and research efforts

for improving technology integration practices, high-level technology use is still low. In general, high-level technology uses tend to be associated with learner-centered or constructivist practices. Rather than using technology in the ways that the literature suggests, teachers tend to use technology mostly for communication and low-level tasks, such as word processing, drill-and-practice activities, and exploring websites, many of which align minimally with core pedagogical goals (Becker, 1994, 2000; Brush & Saye, 2009; Ertmer, 2005; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Strudler & Wetzel, 1999; Willis, Thompson, & Sadera, 1999; U.S. Department of Education, 2003).

To better understand and improve ineffective or inadequate technology integration practices, researchers have examined factors that may affect K–12 teachers' technology integration positively or negatively. Becker (2000) argued that certain conditions can help teachers use technology effectively:

> However, under the right conditions—where teachers are personally comfortable and at least moderately skilled in using computers themselves, where the school's daily class schedule permits allowing time for students to use computers as part of class assignments, where enough equipment is available and convenient to permit computer activities to flow seamlessly alongside other learning tasks, and where teachers' personal philosophies support a student-centered, constructivist pedagogy that incorporates collaborative projects defined partly by student interest—computers are clearly becoming a valuable and well-functioning instructional tool. (Becker, 2000, p. 25)

There are many barriers to integrating technology into teaching and learning. Ertmer et al. (1999) classified technology integration barriers in two major categories: first- and second-order barriers. First-order barriers, which refer to obstacles that are external to teachers, include such barriers as lack of resources, institution, subject culture, and assessment. On the other hand, second-order barriers are intrinsic to teachers and include such obstacles as attitudes, beliefs, knowledge, and skills. Pointing out that the first- and second-order barriers are inextricably linked together, researchers suggest that it is necessary to address both types of barriers rather than addressing them separately (Ertmer, 1999; Hew & Brush, 2007). Hew and Brush (2007) analyzed previous research studies from 1995 to spring 2006 and identified six major categories of the barriers faced by K–12 schools when integrating technology into the curriculum for instructional purposes: (a) resources, (b) knowledge and skills, (c) institution, (d) attitudes and beliefs, (e) assessment, and (f) subject culture. Then they classified strategies to overcome the barriers into five categories: (a) obtaining the necessary resources, (b) having a shared vision and technology integration plan, (c) facilitating changes in attitudes/beliefs, (d) professional development, and (e) reconsidering assessment.

Although previous research provides useful insights into the factors that affect technology integration in general and how to improve professional development efforts, few have examined issues related to learner-centered technology integration. To effectively help teachers create technology-enhanced, learner-centered classrooms, it is essential to understand: (a) how they perceive learner-centered instruction as well as technology; (b) what kinds of barriers they face in creating technology-enhanced, learner-centered classrooms; and (c) what kind of support they need to create such classrooms. Therefore, this study focuses on the following:

1. Teachers' beliefs and attitudes toward the use of technology in learning and teaching
2. Teachers' perceptions of learner-centered instruction
3. Teachers' perceptions of barriers to creating technology-enhanced, learner-centered classrooms
4. Teachers' perceptions of the effectiveness of current professional development programs and suggestions for improvement
5. Teachers' support needs

By examining K–12 teachers' beliefs, perceptions, barriers, and support needs in the context of learner-centered technology integration, this study aims to inform teacher educators and administrators of how they can better support teachers in creating technology-enhanced, learner-centered classrooms.

Method

The researchers used an online survey to collect data in this study. The survey included the following eight sections:

1. Demographic questions
2. Technology beliefs
3. Learner-centered instruction
4. Current practices in creating technology-enhanced, learner-centered classrooms
5. Perceived barriers to creating technology-enhanced, learner-centered classrooms
6. Perceived effectiveness of current professional development programs/suggestions for improvement
7. Support needs
8. Addresses

The researchers developed survey items based on an extensive literature review and feedback from 11 teachers who participated in the pilot testing of the survey instrument. The survey originally included more open-ended questions, but teachers often provided short or vague answers to these questions. Therefore, the researchers added more Likert-style questions and changed wordings. The Results section describes more information about the survey.

The first author sent e-mail invitations, including the link to the online survey, to K–12 teachers in northeast Texas and southwest Arkansas in the United States. To recruit participants, the researchers used Wal-Mart gift cards as participant incentives. The researchers informed the participants that they

Table 1. Technology beliefs *(n* = 126)

Statement	*M*	*SD*
1. I support the use of technology in the classroom.	4.83	.39
2. A variety of technologies are important for student learning.	4.78	.45
3. Incorporating technology into instruction helps students learn.	4.73	.48
4. Technology enables me to accomplish tasks more effectively and efficiently.	4.64	.61
5. Technology is an important part of teaching and learning.	4.56	.52
6. I am willing to take some time to learn and use new technologies.	4.52	.70
7. Teachers should keep up with new technologies.	4.50	.67
8. Incorporating technology into the curriculum isn't my job.	*1.61 (4.39)*	*.75*
9. Teachers should focus on content and pedagogy, and technologists should be in charge of the technology.	*1.69 (4.31)*	*.71*
10. Technology may draw students' attention but is not helpful for student learning.	*1.76 (4.24)*	*.89*

would receive a $10 Wal-Mart gift card if they completed the survey and provided their mailing address at the end of the survey. This study was supported by a research grant from the previous institution of the first author.

The researchers conducted the survey, including Likert-style questions and open-ended questions, from April through May 2010. One hundred twenty-six teachers participated in the study (32% response rate). The participants were from 27 schools (14 elementary schools, 4 middle schools, and 9 high schools) in a number of different rural school districts, including Texarkana Independent School District (TISD), Texarkana Arkansas School District (TASD), and Pleasant Grove Independent School District. The school environments varied from technology poor to technology rich. Of the sample, 93% were female. The teachers had an average of 10.2 years of teaching experience. They ranged in age from 20s to 60s (21–25: 10%, 26–30: 21%, 31–35: 17%, 36–40: 14%, 41-45: 14%, 46–50: 9%, 51–55: 9%, 56–60: 6%, 61–65: 1%).

The researchers collected both quantitative and qualitative data from the online survey. Quantitative data were analyzed by using descriptive statistics. Qualitative data were analyzed using the constant comparative method (Glaser & Strauss, 1967; Strauss & Corbin, 1990). All responses were examined, coded, and constantly compared to other data. In the process, some coded data were renamed or merged into new categories.

Results

Technology Beliefs

Brush, Glazewski, and Hew (2008) developed 12 items that addressed teacher's technology beliefs. By adapting them, the researchers developed 10 items to measure K–12 teachers' technology beliefs (see Table 1). A 5-point scale was used for responses: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

Findings from the Technology Beliefs section of the survey revealed K–12 teachers' positive attitudes toward the use of technology in teaching and learning. This is consistent with Brush et al.'s (2008) field-test results, even though their participants were preservice teachers. Table 1 reports technology beliefs means (*M*) and standard deviations (*SD*) are reported in rank order. The numbers represent responses on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Items in italics are negatively worded, so the transposed value is listed in parentheses.

Overall, participants believed that technology, as an important part of teaching and learning, helps students learn (*M* = 4.73, *SD* = .48) and enables them to accomplish tasks more effectively and efficiently (*M* = 4.64, *SD* = .61). Most participants indicated that they supported the use of technology in the classroom (*M* = 4.83, *SD* = .39) and were willing to take time to learn and use new technologies (*M* = 4.52, *SD* = .70). They also indicated a belief that incorporating technology into the curriculum was part of their job.

Perceptions of Learner-Centered Instruction

The Perceptions of Learner-Centered Instruction (LCI) section of the survey included 11 Likert-style items and 3 open-ended questions. Table 2 (p. 58) reports the means and standard deviations in rank order. The numbers represent responses on the same 5-point Likert scale ranging from 1 to 5.

Overall, participants had positive perceptions of LCI. About 70% of participants agreed or strongly agreed that they were learner-centered teachers, and 27.6% were neutral. Only a few teachers thought that learner-centered approaches are time-consuming, diminish the amount of content they can teach, are incompatible with their subject areas, or require too much work. A majority of teachers believed that LCI is challenging but rewarding (*M* = 4.14, *SD* = .73). Participant responses to open-ended questions also revealed that most participants had learner-centered beliefs.

Whereas about 40% indicated that they had enough knowledge about LCI, a majority of the participants wanted to learn more about it (*M* = 4.14, *SD*= .63). This seemed to be contradictory at first, but qualitative data showed that, although many teachers understood the basic ideas of LCI, they still wanted to learn more about learner-centered pedagogy, especially practical strategies for the implementation of LCI.

Current Practices

This section of the survey included 18 items rated using the same 5-point Likert scale ranging from 1 to 5. Table 3 (p. 58)

Table 2. Perceptions of Learner-Centered Instruction

Statement	*M*	*SD*
1. My job is to teach the material. If some students don't learn it, that is their problem.	*1.46 (4.54)*	*.61*
2. Learner-centered approaches require too much work for me.	*1.75 (4.25)*	*.72*
3. Learner-centered approaches are incompatible with my subject area.	*1.81 (4.19)*	*.83*
4. I want to learn more about learner-centered instruction.	4.14	.63
5. Learner-centered instruction is challenging but rewarding.	4.14	.73
6. Learner-centered approaches diminish the amount of content I can teach.	*1.87 (4.13)*	*.82*
7. Learner-centered approaches are too time-consuming.	*1.89 (4.11)*	*.80*
8. I am a learner-centered teacher.	3.82	.76
9. I am not very familiar with learner-centered approaches.	*2.21 (3.79)*	*.89*
10. My students are passive and not always responsible. They are not ready for learner-centered approaches, in which they take responsibility for their learning.	*2.35 (3.65)*	*.92*
11. I have enough knowledge about learner-centered instruction.	3.15	.99

Table 3. Current Practices in Creating Learner-Centered Classrooms

Statement	*M*	*SD*
1. I provide positive emotional support and encouragement to students.	*4.61*	*.49*
2. I have high expectations of every student.	*4.61*	*.53*
3. I help students feel like they belong in the class.	*4.53*	*.52*
4. I am sensitive to student differences in learning styles, culture, values, perspectives, customs, and so forth.	4.40	.59
5. I allow students to express their own unique thoughts and beliefs.	4.36	.63
6. I encourage students to work collaboratively with other students.	*4.31*	*.63*
7. I monitor individual process continually in order to provide feedback on growth and progress.	*4.30*	*.67*
8. I provide learning experiences that are relevant and meaningful to individual students.	4.28	.57
9. I provide personalized learning experiences that take into account the different needs of individual students.	*4.27*	*.58*
10. I provide learning activities or tasks that stimulate students' higher-order thinking and self-regulated learning skills.	*4.27*	*.64*
11. I give students increasing responsibility for the learning process.	4.25	.66
12. I provide activities that are personally challenging to each student.	4.23	.62
13. I help students in developing and using effective learning strategies.	4.16	.57
14. I assess different students differently.	4.06	.76
15. I help students develop self- and peer-assessment skills.	3.99	.84
16. I provide structure without being overly directive.	3.96	.80
17. I allow students to work at their own individual pace.	3.90	.78
18. I include students in decisions about how and what they learn and how that learning is assessed.	3.88	.79

reports means and standard deviations in rank order. All participants indicated that they were providing positive emotional support and encouragement to their students (M = 4.61, SD = .49). Most participants indicated that they had high expectations of every student (M = 4.61, SD = .53); were sensitive to student differences in learning styles, culture, values, perspectives, and customs (M = 4.40. SD = .59); and helped students feel like they belong in the class (M = 4.53, SD = .52). Most (93%) agreed or strongly agreed that they provided personalized learning experiences that take into account the different needs of individual students (M = 4.27, SD = .58). In terms of assessment, 82% indicated that they assessed different students differently (M = 4.06, SD = .76). Participants gave the lowest ranking to the statements "I allow students to work at their own individual pace" and "I include students in decisions about how and what they learn and how that learning is assessed."

Perceived Barriers

The Perceived Barriers section of the survey included 11 items rated using a 3-point scale ranging from 1 (not a barrier) to 3 (a major barrier). Table 4 reports perceived barriers means and standard deviations) in rank order. Lack of technology, lack of time, and assessment were identified as the major barriers to creating technology-enhanced, learner-centered classrooms, but their mean scores are relatively low. About 57% perceived lack of technology and time as a barrier or a major barrier. A little more than half of the participants (51%) perceived assessment as a barrier or a major barrier.

In terms of knowledge, about 35% indicated that lack of knowledge about

Table 4. Barriers to Creating Technology-Enhanced, Learner-Centered Classrooms

Statement	*M*	*SD*
1. Lack of technology	1.74	.74
2. Lack of my time	1.71	.69
3. Assessment (school and national high-stakes testing)	1.66	.73
4. Institutional barriers (school leadership, school schedule, school rules)	1.46	.59
5. Lack of my knowledge about learner-centered instruction (methods training)	1.44	.59
6. Lack of my knowledge about ways to integrate technology into learner-centered instruction (training in technology integration techniques)	1.44	.59
7. Lack of tech support	1.39	.62
8. Subject culture (the general set of institutionalized practices and expectations which have grown up around a particular school subject)	1.35	.54
9. Lack of my knowledge about technology (tech training)	1.33	.48
10. My attitude toward learner-centered instruction	1.05	.29
11. My attitude toward technology	1.03	.22

Table 5. Perceived Effectiveness of Current Professional Development Programs

Statement	*M*	*SD*
1. They help me improve my technology knowledge.	3.78	.91
2. They help me understand how teaching and learning change when particular technologies are used.	3.47	1.05
3. They help me improve my pedagogical knowledge.	3.46	.91
4. They help me create a technology-enhanced, learner-centered classroom.	3.39	1.02
5. They help me improve my content knowledge about the subject matter I teach.	3.36	1.09
6. They help me create a learner-centered classroom.	3.18	1.05
7. I am satisfied with my current professional development programs and activities.	3.16	1.09
8. They provide subject-specific technology integration ideas.	3.13	1.00
9. They focus primarily on how to merely operate the technology.	2.93	1.07
10. They provide some technology integration ideas but they are too general to be applied easily to my classroom.	2.85	1.00

learner-centered instruction and ways to integrate technology into learner-centered instruction are barriers to creating technology-enhanced, learner-centered classrooms. Participants gave the lowest ranking to "my attitude toward technology" and "my attitude toward learner-centered instruction." Most (98%) believed their attitude toward learner-centered instruction were not a barrier.

The researchers identified other barriers that Table 4 does not address from participant responses to an open-end question. These include lack of funding, limited resources, student behavior, class size, inclusion of severe-needs students, and parents who complain about challenging activities.

Evaluation of Current Professional Development Programs

This section included 10 items rated using the same 5-point Likert scale ranging from 1 to 5. Table 5 reports the perceived effectiveness means and standard deviations. About 43% indicated that they were satisfied with their current professional development programs and activities ($M = 3.16$, $SD = 1.09$). Participants gave the highest ranking to the statement: "They help me improve my technology knowledge." About 70% indicated that their professional development programs helped them improve their technology knowledge.

Participant responses to open-ended questions identified the major weaknesses of current professional development programs as:

Programs are too broad and not subject specific. A number of participants pointed out that most of their current professional development programs tend to be very broad and do not provide subject-specific information or examples. Participant responses included: "Most of the professional development we have is to merely teach us how to use the specific system, and any examples that they give us are so broad it is hard to target it to one specific subject area, especially math," and "Not enough subject-specific and certain learner-specific information. We need more ideas for our certain subject areas involving technology."

Programs cram too much information into short trainings. Participants reported that their current professional programs provide way too much information at one time, and they don't have enough time to practice and thoroughly learn what is being presented to them.

In terms of technology training, participants pointed out that many technology training sessions are geared toward new users, and they often teach about technology that is not available to teachers. Participant responses included: "They are geared towards a new user … so many times I find myself bored or attending something that I have already prior knowledge of, or have been using already," and "The problem with our professional development

is that many times we have had to attend technology training for technology that we do not have in the classroom and are not expected to receive."

Several participants reported that they had no or few opportunities for professional development. Specifically, kindergarten teachers mentioned that most professional development programs were for older students. On the other hand, some people mentioned that their districts provided many opportunities to explore and learn more about technology and learner-centered instruction.

Support Needs

Ways to improve professional development programs. How could professional development programs be improved to better help teachers create technology-enhanced, learner-centered classrooms? Participants suggested that they (a) allow time for hands-on practice; (b) be subject-specific; (c) provide more training about learner-centered instruction; and (d) stop telling and show how to create technology-enhanced, learner-centered classrooms. Specific participant responses included:

- "Give teachers time during in-service training to really get the hands-on training we need to provide effective instruction to our students."
- "Break it up into area-specific workshops. Right now, all teachers are thrown into the cafeteria together to all learn the same thing during in-service. That really doesn't work... What English teachers need to learn is different than what the Computer teacher or the Art teacher needs to know … but the district doesn't want to spend the time or money to train small groups. They prefer the 'one size fits all' mentality."
- "More training about learner-centered classrooms"
- "Have someone come in and demonstrate this type of classroom. Give lesson plans, activities, and ways to organize and get started."

Institutional support. In terms of institutional support needed to create technology-enhanced, learner-centered classrooms, participants indicated that they needed (a) more equipment, technology, or funding; and (b) more training, workshops, models, and examples. They also believed that schools need to (c) focus more on students and learner-centered instruction and (d) focus less on state test scores. Specific participant responses included:

- "More focus starting in K on learner-centered instruction."
- "Learner-centered strategies need to start in elementary so that they [students] will be comfortable with this approach."
- "Schools need to focus on students beginning at the youngest age and not on the TAKS test. They need to start with the 4-year-olds and build a base of knowledge using technology. The students with even the most severe disability should be included in all technology decisions."
- "Schools need to quit focusing so much on the state tests and more on the students, and they will see more well-rounded students as well as good test scores."

A small number of the participants pointed out the need for mindset change, customized or individualized support, tech support, more planning time to research and develop ideas, more freedom to incorporate new ideas, longer class periods, and smaller classes.

Discussion and Conclusion

The findings of this study are from 126 teachers in northeast Texas and southwest Arkansas. Their generalizability is unknown. However, they provide useful insights into how to support teachers in creating technology-enhanced, learner-centered classrooms.

Implications for Professional Development

Strengthened links among technology, pedagogy, and content. The results of this study show that much technology integration training appears to focus mainly on technology knowledge and skills while overlooking the dynamic relationships between technology, pedagogy, and content. As a result, teachers learn about much "cool" stuff, but they still have difficulty applying it for their students' learning. As noted already, technology integration requires much more than technical skills. Technology integration training must help teachers develop TPACK by providing them with subject-specific technology integration ideas and opportunities to explore technologies in authentic teaching and learning contexts. Teachers should be able to build technology skills in the context of designing learner-centered learning activities in their subject areas (Brush & Saye, 2009; Ertmer, 2003; Hew & Brush, 2007; Mishra & Koehler, 2006; Koehler & Mishra, 2008; Polly & Hannafin, 2010).

More training on learner-centered instruction. Becker (2000) pointed out that teachers are much more constructivist in philosophy than in actual practice. Research studies have documented incongruence between teachers' beliefs and practices (Lim & Chan, 2007; Peterson, 1990; Polly & Hannafin, in press; Wilson, 1990). It is possible that teachers who are learner-centered in philosophy are teacher-centered in actual practice. Learner-centered philosophy does not necessarily lead to learner-centered practice. Many things can cause such inconsistency. Based on our findings, it appears that lack of knowledge about LCI might prevent teachers from creating learner-centered classrooms, even though they are learner-centered in philosophy. Most participants in this study indicated that they wanted to learn more about LCI, especially practical strategies. Many of them suggested that professional development programs provide more training on LCI. It is clear that there is a need for more training on how to implement LCI.

Customized and learner-centered training. Pointing out the different needs of different teachers, the participants of this study reported that the "one size fits all" approach does not work. They also suggested that professional development programs provide more time for "hands-on" practice rather than cramming a large amount of information into a short training. To better help teachers create technology-enhanced, learner-centered

classrooms, professional development must take into account teachers' needs; provide active, hands-on, and learner-centered learning experiences; and provide personalized support.

Vicarious experiences. The effectiveness of observational or vicarious learning is well known (Bandura, 1997). Previous research suggests that vicarious experiences, especially observing successful others, can not only provide how-to information but also increase teachers' confidence for performing successfully (Ertmer, 2005; Schunk, 2000). The participants of this study also suggested that professional development programs stop telling and show or demonstrate how to create technology-enhanced, learner-centered classrooms. However, locating high-quality models and exposing teachers to the models are difficult. Realizing the difficulties involved in providing various experiences, researchers have suggested presenting models via electronic media, such as video or web-based tools (Albion, 2003; Brush & Saye, 2009; Ertmer et al., 2003; Ertmer, 2005).

Communities of practice or social networks. Noting that teachers' beliefs and practices are continually shaped by the values, opinions, and expectations of influential others, researchers have suggested building communities of practice, social networks, or collegial groups in which teachers can share and explore new teaching methods and tools and help each other (Becker, 1994; Becker & Riel, 1999; Ertmer, 2005; Kopcha, 2010; Marcinkiewicz & Regstad, 1996; Orill, 2001; Putnam & Borko, 2000). Appropriate communities of practice or social networks have the potential to provide ongoing support outside the formal training.

Paradigm Change

Interestingly, teachers appeared to face more first-order barriers, which are external to teachers, rather than second-order barriers, when creating technology-enhanced, learner-centered classrooms. Lack of technology and time, assessment, and institutional structure turned out to be the top perceived barriers. This suggests that improving professional development programs is insufficient. As the participants suggested, schools need to focus more on learner-centered instruction and less on state test scores, beyond providing technology tools and training. For this to happen, more fundamental changes to our education system would need to occur. Pointing out that our current education system was designed more for sorting than for learning, Reigeluth (1994, 1999b) contends that there is a need to change our current paradigm of public education to one better suited to the educational needs of the information age.

Specifically, Reigeluth and Duffy (2008) argue that three paradigm changes must occur in parallel to achieve a paradigm that is learning-focused rather than sorting-focused: (a) transforming teaching and learning to a paradigm that is customized and attainment-based, (b) transforming the school system's social infrastructure to a participatory organization design, and (c) transforming the relationship between the school system and its environment to a collaborative and proactive stance. As they emphasize, the paradigm change requires helping all stakeholders to evolve their mindsets about education. Even if teachers have all the knowledge, skills, attitudes, and tools they need, they will not be able to create effective learner-centered classrooms if they still have to cover a large amount of content in a short time and focus on preparing students for high-stakes tests. It appears that effective learner-centered learning experiences require all those involved with the system, including administration, parents, and students, to support the learning-focused paradigm and be willing to perform the new roles that the new paradigm requires.

Suggestions for Future Research

Further studies might test the generalizability of these results by examining K–12 teachers' beliefs, perceptions, barriers, and support needs in the context of creating technology-enhanced, learner-centered classrooms in different school districts, states, or countries. Second, future research could examine the issues related to learner-centered technology integration in greater depth using observation and interviews in addition to an online survey. Also, it would be useful to involve students and other stakeholders as well as teachers. Third, further research is needed to explore various ways to design and implement professional development programs that are learner-centered and subject-specific; show how to create technology-enhanced, learner-centered classrooms; provide hands-on learning experiences; and help teachers develop TPACK. Finally, future research could explore ways to help all stakeholders to evolve their mindsets about education.

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