Classroom-embedded Student-supported Technology Professional Development that Supports Constructivist Teaching Practices

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Abstract: This paper questions the assumption that lack of effective technology use in classrooms is due to a shortage of professional development. There is evidence to suggest that this is not true, but that instead, the professional development teachers receive does not adequately prepare them for using technology, and further, teachers are not adequately supported once back in the classroom. To add to these needs, constructivist learning environments require teachers to develop more expertise not only in technology but also in pedagogy.

This paper proposes that traditional professional development is ill-suited to teaching teachers how to create constructivist learning environments using technology. As a solution, it proposes models of student-centered, student-led support for teachers that support classroom practice aligned with the attributes of constructivist learning environments. These models situate teacher learning about technology in their own classroom, reinforce constructivist teaching practices, provide support for technology use in the classroom, and enrich learning environments for students.

Keywords: Classroom-based learning, Change processes, Learning communities, Teacher education, Theories and philosophies of learning

1. Introduction

Constructivist learning environments are characterized by learning by doing, experimentation, authentic work, student agency, serendipity, reflection, collaboration, and community expertise. They require teachers with intellectual curiosity, creativity, ongoing personal learning habits, and the ability to collaborate with students while maintaining a classroom that has both purpose and freedom. Such teachers are able to create learning environments that are distinguished by intellectual challenge, wonder, social interaction, and student engagement. (Harvey, 1993; Papert, 1992; Stager, 2005)

Although technology enables constructivist learning, it requires substantially more technical and intellectual fluency from a teacher than the typical computer application courses found in many schools. This makes the professional development challenges more substantial.

Regardless of its merits, constructivist learning, and in particular, technology enabled constructivist learning, has proven difficult to sustain in traditional schools. While Papert attributes this to school's "immune reaction" to an invading foreign body (Papert 1997), conventional wisdom ascribes this failure to lack of teacher professional development.

2. The myth of insufficient professional development

The speculation that the primary barrier to effective technology use in schools is the result of insufficient professional development goes unquestioned and has become a myth used to excuse the lack of progress. "Lack of professional development for technology use is one of the most serious obstacles to fully integrating technology into the curriculum (Fatemi, 1999; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997)." (in Rodriguez and Knuth, 2000)

Even when the style of professional development is called into question, the typical remedy is to layer on additional structure, evaluation, and more emphasis on external expertise. Critiques from a wide spectrum of researchers focus on variables such as evaluation, seat time, correlation to mandated curriculum standards, testing outcomes, and compensation. Occasionally, issues of teachers' motivation to learn are mentioned. (Brand, 1997; Rodriguez and Knuth, 2000)

However, surveys show that, American (and most Western) teachers are receiving quite a bit of professional development related to technology.

Indeed, most teachers had participated in multiple professional development activities in the year prior to taking the survey, and yet more than 80 percent indicated a need for training in how to integrate technology into the curriculum. (SRI, 2002)

Most teachers indicated that professional development activities were available to them on a number of topics, including the use of computers and basic computer training, training on software applications, and the use of the Internet (ranging from 96 percent to 87 percent). Among teachers reporting these activities available, participation was relatively high (ranging from 83 to 75 percent), with more experienced teachers generally more likely to participate than less experienced teachers. (NCES, 2000)

In a 2003 study of teachers in the Chicago Public Schools, a large majority of teachers confirmed that lack of professional development was not a great barrier to technology use. (CCSR, 2003)

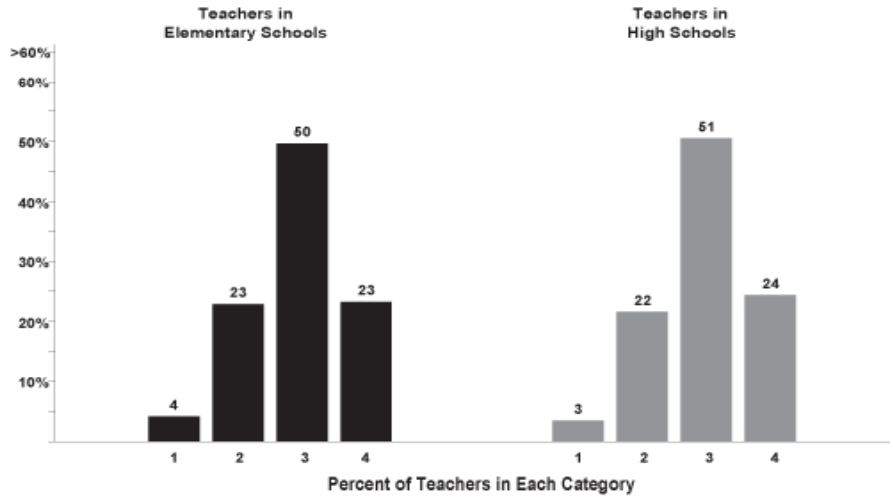

Figure 1. and Table 1. Teachers' assessments of their awareness of and participation in professional development activities designed to integrate technology in the classroom.

Category	In Chicago Public Schools:
1 - Very Weak	Teachers agree that the lack of both appropriate professional development and release time for learning and planning are great barriers to technology use.
2 - Weak	Teachers somewhat agree that lack of both professional development and release time to be great barriers to technology use.
3 – Strong	Teachers find lack of both professional development and release time as small barriers to moderate barriers.
4 – Very Strong	Teachers describe the lack of professional development and release time as not a barrier.

3. Failure of traditional professional development

The failure of traditional professional development to change teacher practice with technology may be due to several factors. Effective use of technology, such as those sought in a constructivist learning environment, extends well beyond understanding the specific technology. It requires a different teaching style. Traditional approaches to professional development tend towards the didactic, while the real power of the computer is when it's used in a personally meaningful, constructive fashion.

Federal, state and local agencies are investing billions to equip schools with computers and modern communication networks, but only one-third of our nation's teachers feel well prepared to use computers and the Internet in their teaching. (NCES, 2000)

Despite the evidence that traditional professional development is ineffective, there remains an insatiable appetite for more. Perhaps the important variable isn't quantity, but constancy and community.

4. Moving professional development into the community of practice

The primary community of practice for teachers is within the confines of their own classroom. The participants are the teacher and her students. Other peripheral participants can visit, but for most classrooms, these visits are few and short. While teachers may participate in other communities in a professional capacity, for most, the classroom is the only setting for their professional practice.

Wenger, in discussing designs for learning inside communities of practice, makes the point that they, "…cannot be based on a division of labor between learners and nonlearners, between those who organize learning and those who realize it, or between those who create meaning and those who execute." (Wenger, 1998)

Traditional forms of professional development remove the teacher from their classroom and attempt to create a community of practice made up of teachers and technology experts. This community exists only for the purpose of imparting information from the experts to the teachers. While there is certainly a place for collegial discussion and access to professional improvement, it is not unreasonable that teachers often reject transparent efforts to force them into participation.

Common recommendations for technology professional development include that teachers be given more time for "independent practice without fear of embarrassment," to watch expert practitioners, go to conferences and workshops, or participate in online learning communities. (Rodriguez and Knuth, 2000)

These attempts to improve technology professional development only serve to reinforce the separation between the teacher learning new skills and real change in

classroom practice. Schlager & Fusco construct a compelling argument based on years of design and facilitation of Tappped-In, an online teacher community. This type of professional development, "… tends to pull professionals away from their practice, focusing on information about a practice rather than on how to put that knowledge into practice." (Schlager and Fusco, 2004)

Meaning, mere discussion about practice does not create a community of practice. Even if professional development excites teachers about new possibilities and tools, the teachers are removed from the successful context and sent back to the classroom to fend for themselves. They are expected to use their new skills without colleagues or experts present. One-on-one coaching that provides in-class mentoring is expensive and rarely available. Online teacher communities can only take place outside of classroom time, too late for any intervention or advice to be useful. As teachers struggle alone in their classroom with questions, issues, and problems, valuable teachable moments are missed.

In an interview discussing what changes need to take place in classrooms to allow project-based learning, Papert says, "What we need is kinds of activity in the classroom where the teacher is learning at the same time as the kids and with the kids. Unless you do that, you'll never get out of the bind of what the teachers can do is limited by what they were taught to do when they went to school." (Papert, 2001)

Creating sustainable systems that allow teachers to learn alongside students in the classroom is imperative to support teachers responsible for sustaining constructivist learning.

4.1 Research from a student-led classroom technology support model for teachers

GenYES is a model of reverse mentoring developed specifically for K-12 teachers learning to use computers in their classrooms. GenYES students learn about technology, develop planning and collaboration skills, and learn how people learn. As a culminating project, each student is partnered with a teacher in the school. These student/teacher teams review the teacher's curriculum and decide on a future lesson that could be enhanced with technology. The student then researches and creates the project, with the teacher providing insight into pedagogy and the curricular content. When the project is completed, the teacher has something they can use in their classroom, understands technology better and can directly observe the impact on their students. (Harper, 1998)

"[In the GenYES model]…a unique on-site mentorship was developed. Students attended training sessions to become technology mentors and then worked individually with teachers to help them develop technology-focus projects. The training sessions were developed into a specific curriculum that was often taught as an elective in middle and high school and as an extracurricular unit for elementary students." (Zhao et. al., 2006)

Examples of GenYES projects might be setting up and creating sample templates for software the teacher will use in a class project; having the GenYES student come in to the classroom and help younger students create and edit movies while the teacher provides the lesson objectives; or a student setting up and maintaining a lab set of probe-ware for handhelds used in a science class, freeing the teacher from having to do tech support tasks, or having to cancel a lesson due to hardware issues. The goal is for the GenYES student to facilitate the use of technology in the classroom and provide the teacher with a real demonstration of the power of technology. Typically, teachers are much more receptive to further instruction in technology tools and applications after seeing them successfully used in their own classroom with their own curriculum. These teachers receive both informal and formal training in the use of hardware and software, but all done in context of their own classroom and curriculum needs. (Harper, 1998)

In the GenYES model, a single teacher or staff member facilitates all of this as the GenYES lead teacher. A decade of research demonstrates that this model improves teachers' use of technology in the classroom and changes teacher attitudes about the usefulness of technology as they view the benefit to their students. (Coe, 2003; Harper, 1998) Over the last 10 years, the model has been called Gen Y or Generation www.Y, but is now known as GenYES

"The format provides a model of project-based, authentic, student-centered, multidisciplinary teaching and learning enhanced by technology." (Coe, 2003)

This partnership creates a two-person collaborative learning community grounded in constructivist pedagogy. Both the student and the teacher are bringing important skills and knowledge to the partnership. Improving technology use in schools is an authentic problem worth solving. Working together over time creates mutual respect and understanding about each other's roles, and gives the teacher help when and where they need it.

The model facilitates a constructivist atmosphere in the whole school, not by teaching teachers how to teach, but by giving students an authentic problem to solve and asking teachers to help. GenYES builds on the pedagogical models developed by Dr. Papert and the years of research about what constructivist teachers do in classrooms.

- Teachers working with GenYES students report that the experience helped them better understand technology and its place in education.
- 89% agreed that as a consequence of GenYES, their students learned content better
- 98% reported that as a consequence of GenYES, they would continue rebuilding their lessons to make more use of technology
- 82% reported that the GenYES experience would change the way they teach in the future
- 95% of the partner-teachers consider GenYES a good method for providing support and assistance to teachers as they integrate technology into their classes (Coe, 2003).

4.2 Constancy and community in the classroom

Although the GenYES model is a structured mentoring process with a specific focus, it sheds light on the steps and key factors needed to create a classroom community of practice that supports constructivist learning.

In the classic explanation of social constructionism, Papert describes the Brazilian samba school where, "Novice is not separated from expert, and the experts are also learning." (Papert, 1980)

"[In the GenYES model] … teachers had multiple experiences to explore the use of technology with their student technology guides, who in turn could support the teachers in solving any problems they encountered." (Zhao et. al., 2006)

By creating a classroom-based learning community like GenYES, the problems of constancy and community are solved. Teachers and students can be teachers, learners, novices or experts. Roles can shift from day to day, task to task. Teachers can try new technology knowing that their students have expertise, or if not, the class can learn it together. Together, they are doing the real work of learning. This community of practice is available all the time and not dependent on outside expertise.

There is of course a role for outside expertise, but accessing an outside expert and sharing it with a community allows the whole community to benefit. Modelling that behavior for students creates an expectation that learning to learn is the key to success.

5.

5.1 Fear of failure

Fear of failure, of looking stupid, and of losing control also play a large part in whether a teacher can create an environment that allows students to take the lead. Teachers often create carefully staged lessons in technology based on their own fear of the computer, rather than a true understanding of what students need to know. By creating a delay in the process of students getting to the real work, teachers assuage their own fears, but bore students. Recommendations that teachers practice new technology skills in private only serve to intensify this fear by acknowledging that mistakes are shameful and will somehow harm students.

5.2 Technology choice, implementation, and support as an authentic problem

Authentic problems inspire creative thinking and empower students to exceed expectations and think creatively. Technology in education has many authentic problems beyond the use in the classroom. Selecting the right tools, creating acceptable use provisions and penalties, making decisions about security, analyzing costs, and planning for maintenance are all considerations.

Teachers can sometimes act as roadblocks in technology use as their quest to find the perfect technical solution and design a flawless implementation plan takes months or even years to complete. Students can shortcut this process and learn valuable lessons along the way.

5.2.1 Students as teachers

It is not unusual for students to serve in the role of teachers in schools, although these are usually near-age peer tutoring programs. In technology settings, the research done on children as software designers (Harel, 1991; Kafai, 1995) outlines multiple benefits of students collaborating and teaching each other as they design educational software and games. However, there are ways that students can teach peers, teachers, and other members of their community about technology that benefit the entire school. By creating a legitimate role for students of this digital generation to share their experience and facility with technology, schools can create in-class professional development opportunities for teachers, support teachers as they use technology in the classroom, and provide better technical support to teachers in the classroom.

This does not mean that students can just be told to help out and this will automatically have a significant impact. The success of a carefully structured model like GenYES shows that these students need guidance to learn new roles and be successful collaborators and teachers. Teachers and staff need guidance as well and time to learn to trust and accept new roles for students.

5.2.2 Students as teachers of teachers

In the GenYES model, students serve as teachers in one-on-one partnerships with teachers. The model supports both students and teachers as co-learners and co-teachers. Building on a time honoured practice of students “helping out” GenYES is a non-threatening, yet subtly subversive way to have students contribute to the technology-enabled learning environment.

Papert said about the GenYES model, “The genius of this idea is that by contributing to solving a recognized problem facing schools, it rallies support from schools for something that goes against the grain of their traditional ways of thinking.” (Papert, 1998)

Our research indicates that teachers are not embarrassed by students teaching them about technology. Teachers became teachers because they like children. The

key is creating a school-wide environment where the teacher and student interaction and knowledge sharing is a normal and accepted practice.

5.2.3 Students as teachers of peers

Student peer mentoring can also serve as a primary support system for constructivist learning environments. Student mentors leverage student expertise and benefit both students and teacher. Peer mentors:

- Increase available opportunities for all students. Other students can get assistance more quickly and in more areas than if the classroom must rely on a single expert (the teacher) or wait for outside expertise.
- Allows the teacher to teach. The teacher is relieved of the role of sole technology guru and can focus on helping struggling students, focus on bigger ideas, and be attuned for teachable moments.
- Expand the capacity for multiple applications and hardware. Individual students can become expert in an application or a particular use of technology and help others.

Encouraging student expertise in technology mentoring also creates leadership opportunities for students that support their own personal interests and learning styles. They will learn these skills more deeply and with greater enthusiasm than a student asked to learn a little bit about a lot of applications. A spreadsheet expert can be as important and celebrated as a student with expertise in animation, 3D design or music composition. If these unique gifts and interests are recognized and honored in the classroom, teachers, students, and the mentors themselves benefit.

In addition, the social, academic, and behavioral benefits of peer mentoring for both the mentor and the mentee are well documented (Gartner & Riessman, 1993, Benard, 1990, Viadero 2003). This is especially true in at-risk communities, where peer mentors can bridge cultural gaps between teachers and students. (Snow, 2003, Rohrbeck, 2003)

We have formalized this model in a student technology literacy program called TechYES. Research on the TechYES model shows that teachers report increases in a wide array of student technology skills, as would be expected, but also report increases in student and mentor self-esteem, interpersonal skills and academic skills. In addition, teachers reported that this model increased their understanding and ability to teach in a project-based, open-ended way than prior to teaching the TechYES class. (Schneider, 2006)

5.2.4 Students as technical support

Another way students can serve as support for teachers using technology in the classroom is as technical support. This solution has many benefits for both teachers and students. Teachers with consistent access high-quality technology support use technology more with students, and in a wider variety of ways, than teachers with inadequate technology support programs. (Ronnkvist et. al., 2000)

Students benefit from the challenges and responsibility given to them. Students learn how to troubleshoot and find answers by researching them, not being told. The problems found in school computers are authentic, varied and the need is high. Students also work well with teachers, at least as well as hired technical support staff. Students' knowledge of the school, the culture, and the teachers helps them solve problems in ways that support the learning environment.

6. Conclusion

The only resource in abundance in schools is students and their boundless energy, passion and enthusiasm for learning. By creating structures in classrooms and schools that encourage and support student participation in creating constructivist learning environments, we improve teacher practice and diminish dependency on outside expertise for teacher professional development.

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