MEET THE PROMISE OF CONTENT STANDARDS:

THE ROLE OF TECHNOLOGY FOR TEACHER AND STUDENT LEARNING

learningforward

TRANSFORMING PROFESSIONAL LEARNING

Learning Forward's Transforming Professional Learning to Prepare College- and Career-Ready Students: Implementing the Common Core is a multidimensional initiative focused on developing a comprehensive system of professional learning that spans the distance from the statehouse to the classroom. The project will reform policy and practice and apply innovative technology solutions to support and enhance professional learning. With an immediate focus on implementing Common Core State Standards and new assessments, the initiative provides resources and tools to assist states, districts, and schools in providing effective professional learning for current and future education reforms.

Sylvia Williams, an experienced third-grade teacher, recently has taken on a leadership role with all teachers in her school as they hone their practice to increase student achievement. From interviews with the teachers, she identifies several ongoing challenges, some of which stem from new Common Core standards. Many teachers express confusion; others experience overwhelming helplessness as they adjust their curriculum and instruction to meet the changes represented by the standards. The teachers tell Williams that math poses an especially daunting and contradictory responsibility. As they explain it, "The introduction of geometry has moved to the fourth grade from the third, whereas 'old' third-grade materials are now used in the first grade!" Williams spends many hours researching online and elsewhere and even more time bringing what she finds back and forth to her teachers. Some materials and resources prove usable and worthwhile; others lead to the wrong place or to nowhere.

Williams and her colleagues know that to be effective as teachers of the new standards, they will need to give students substantially different instructional resources that promote application of their learning in authentic situations. Their state offers online resources including assessments, instructional units, and other materials aligned to the new standards. With the shifting of concepts into curricula of different grade levels, many teachers are teaching new concepts. Their main challenge, however, is not teaching concepts for understanding. It is finding appropriate applications of the concepts to deepen and enrich students' learning.

As most teachers do, they turn to other teachers locally and in online networks and the web for resources; however the process of locating, screening, and analyzing instructional resources proves to be time consuming and results in little that will support

deeper learning. So Williams and her colleagues share what they find, continue to look for good examples that they can adapt, and hope that as more and more teachers begin to teach the Common Core standards, higher-level instructional resources will become more abundant and easier to access.

The state plans to continue developing resources for inclusion in its instructional support system, and publishers will continue to develop more resources tied to the standards. In these early stages of standards implementation, Williams acknowledges that many teachers are unwilling to post lessons, units, and instructional resources because they do not yet think they are doing justice to the standards. She trusts that, as teachers build greater confidence in their own understanding of the standards and how to redesign instruction and learning to achieve them, they will be more willing to share what they are developing. Time and persistence, she believes, will yield better instructional resources as more teachers engage students in a new kind of learning experience and design and share resources that are more aligned with new standards.

INTRODUCTION

F ew would dispute that the work of schools is changing because the world—and one's understanding of it—is changing; but, perhaps none feel it more deeply than the teachers who are trying vigorously to adapt their instruction so that their students graduate from high school college and career ready. Research from Scholastic and the Bill & Melinda Gates Foundation (2012) found that teachers say they need more tangible learning resources such as instructional materials workbooks, technology, software programs, textbooks, and mixed media. Many teachers say also that they need support to help them learn best practices and to master strategies for differentiation of instruction to address individual student learning needs. Furthermore, they want to learn teaching practices that instruct and engage students in the best possible ways. Last, teachers say that professional learning has a strong or very strong impact on student achievement (Killion, 2012).

Given their specific requests and readiness for improvement, teachers and those who support their growth and development continually look for resources to meet teachers' needs. Traditional textbooks, while useful, are insufficient to address many of the questions; moreover, few have the types of authentic application tasks and complex texts that new standards require. As a result, teachers and others look beyond resources already in their schools and districts to colleagues, social networks, and the web for answers to their questions.

Because teachers rely on web-based and other technology solutions, it is important to consider the following questions, "How does technology support teachers' efforts to plan, facilitate, and assess their students' learning and their own professional learning?" "Are academic results improved as a result of using new technologies and electronic resources?" "What kinds of professional development do teachers need in order to use these technologies and resources effectively?"

This brief describes the experiences of a small group of Kentucky teachers who participated in an exploratory study in which they applied technology solutions to support their own learning and that of their students. The volunteer teachers were already using various technology solutions to develop their classroom curriculum, own knowledge, teaching practice, and student learning. The hypothesis of this study is that content-rich, easy to access, web-based technologies facilitate multiple aspects of teachers' work such as planning, collaboration, instruction, personalization of materials, student assessment, data management and professional learning. This study focused on teachers' use of technology rather than the technologies themselves. It documented what teachers said they wanted in technology, how they used it, and the advantages and challenges they experienced. As a result, the report does not emphasize which technology solutions teachers used most often or which ones they found most beneficial.

EXPLORATORY STUDY OF TECHNOLOGY SOLUTIONS

n the spring of 2013, nine Kentucky teachers of kindergarten through eleventh grade volunteered to consider questions like those on page 5 in an exploratory study of selected technology solutions. The Bill & Melinda Gates Foundation supported the study as a part of Transforming Professional Learning to Prepare College- and Career-Students: Implementing the Common Core. This initiative focuses on how educator professional learning must change to support deep implementation of Common Core standards, new assessments, and educator evaluation systems. Part of the transformation of professional learning is the use of technology to personalize and expand access to professional learning for all educators so they have the needed supports to implement the Common Core standards. At the conclusion of the study, the volunteer participants received a stipend for their participation in which they examined five technology solutions, provided insights into how teachers think about technology to support their work and learning and offered information to inform Kentucky's selection of additional resources for the statewide Continuous Improvement Instructional Technology System (CIIT System).

The recommended technology solutions included Teaching Channel, LearnZillion, BloomBoard, and PD 360. Some technology solutions currently receive or previously received funding from the Bill & Melinda Gates Foundation for development as a teacher development resource. PD 360 is integrated into the Kentucky CIIT System as a professional learning resource and is widely available to every teacher in the state. The other technology solutions were new to the participants. Each recommended technology solution is described in Table 1.

Table 1. Technologies Used by Teacher Participants

Name of Technology	Website	Description
BloomBoard	www.bloomboard.com	BloomBoard is an open marketplace for teacher professional development resources and tools and also offers observation and evaluation tools as well as individualized professional learning plans and personalized recommendations for continuous improvement. It provides teachers and principals the technology to manage observation, feedback, and support for teachers.
Continuous Improvement Instructional Technology System	www.education.ky.gov/curriculum/ciits/pages/default.aspx	CIITS provides Kentucky public school educators with a web-based, dynamic technology solution that links content standards, multimedia curriculum and instructional resources, additional reviewed, teacher-developed instructional resources, formative assessments aligned to the standards, dynamic student data reporting including state and classroom test data, educator evaluation, and professional learning to support highly effective teaching and learning in every classroom in Kentucky.
LearnZillion	www.learnzillion.com	LearnZillion is a learning platform that combines video lessons for tutorials, assessments, and progress reporting. Each math or ELA lesson highlights a Common Core standard. More lessons focus now on math and others are being added. The work grew from teachers' desire to have the right lessons to meet students' needs and to share best practices across classrooms. Through innovative analytics, teachers are able to discover which lessons have the greatest impact on student learning, access lessons for their students, post lessons, and share ideas with colleagues.
PD 360	www.schoolimprovement.com	The School Improvement Network provides PD 360 and CC 360, both online and on demand video resources for professional development which teachers can access any time and anywhere. The searchable libraries provide thousands of content-specific, grade-specific video examples of master teachers and content from leading education experts.
Teaching Channel	https://www.teachingchannel.org	Teaching Channel is a non-profit organization that showcases videos of innovative and effective teaching practices in America's schools. Videos are available via the Internet and are broadcast in certain markets on local television channels.

The participants in this pilot study were teachers of language arts, mathematics, sciences, technology, and reading at various grade levels (K–11). Table 2 describes the teachers, type of school systems, grade levels, and content areas. As a part of their commitment to participate in the exploratory study, each volunteer agreed to use at least two of the suggested technology solutions three or more times during a four-month period. They also agreed to (a) identify any other technology resources they used regularly to support implementation of Kentucky Core Academic Standards; (b) complete four online surveys about their use and experience; and (c) participate in an end-of-project focus group discussion. Most of the participating teachers had strong technology competence and comfort. Some of the group held positions as instructional coaches, demonstration teachers, and/or lead teachers.

Table 2. Teachers who Participated in the Study

Teacher	Type of District	Grade	Subject
A	Large urban	3	Reading, Language arts
B	Large urban	K-5	Technology
C	Medium city	5	All subjects
D	Medium city	6–9	Math
E	Medium city	7	Science
F	Small rural	7–8	Math
G	Large urban	8	Math
H	Large urban	9	Physical science
I	Medium city	10–11	Math

Technology Usage During the Four-Month Study

Teachers' self-reported uses of one or more of the technology solutions varied over the four months. Table 3 presents a summary of the ways in which they used the technologies each month. it also summarizes overall technology use for each month.

Table 3: Teachers' Uses of Technology Solutions during Four-Month Study

Uses of Technology Solutions	Month One: February	Month Two: March	Month Three: April	Month Four: May	Total Uses by Type
Planning instruction	9	5	3	8	25
Instructional materials for teacher use	2	5	3	2	12
Instructional materials for student use	1	2	1	2	6
Personalizing learning for students	1	0	2	3	6
Assessing student progress	2	1	2	1	6
Data management	1	0	0	0	1
Professional learning to develop own or others' knowledge, skills, and/or practice	0	4	7	6	17
Total Uses Each Month	**16**	**17**	**18**	**22**	**73**

Month One: Teachers Begin Using Technologies

In February 2013, only five teachers completed the first month's survey. Low participation was due to the fact that participants' engagement was just beginning; four other participants were not fully enrolled into the study until the third week of the month. The five participating teachers reported using all of the technology solutions available at least once and found all of them useful. The single exception was a participant who judged one solution not useful or relevant. Although planning was the most frequently reported use for the technologies (See Table 3), participants also mentioned finding instructional materials and personalizing learning to address different student needs as reasons for using technologies.

> Besides PD 360, I used the Express Test feature of CIITS four times. I worked in collaboration with a second-grade teacher, a third-grade teacher, and an instructional resource teacher. We administered a math assessment to the 2nd grade and a reading assessment to the 3rd grade. It was definitely a learning experience for us (the teachers) as well as the students. Creating the test was

fairly simple. The web site is easy to navigate and has a wealth of information right at our finger tips! It was wonderful to be able to create an 'automatic assessment' so easily and be able to analyze the test scores immediately afterwards.

The students and teachers were able to experience and become comfortable with the types of questions that will be on the state assessments. In taking the tests, students learned what test-taking strategies worked and which ones didn't. Teachers were also able to identify students' strengths and weaknesses quickly in order to adjust instruction.

—Teacher B

Technology as instructional material for students and teachers. Some teachers observed improvement in student results. Specifically, one teacher saw improvements in conceptual understanding on exams, as well as in increased student engagement. Another teacher concluded that students succeeded, in part, because the way he used technology to teach a standard was the way that students would practice the standard. A third teacher's students all showed improvement in concepts on which they had been previously unsuccessful. Furthermore, the interactive nature of the technology used offered opportunities for both remediation and challenge. The teacher reported that using technology in instruction helped address the achievement gap, male students' learning styles, the need for differentiation, and the pace of learning skill sets.

Teachers also turned to technology for resources to strengthen their teaching practice. One reports:

I looked for things that seem like I could use them to solve a problem I have in as little time, with as little work as possible. Teaching Channel was my first choice because videos answer lots of questions reading or a PowerPoint won't answer. Teaching Channel has videos of lessons, pieces of lessons, and most helpful for me, experiments. . . I was teaching students the basics of the atomic structure in class. I watched three Teaching Channel videos and learned more about how to differentiate instruction. After the videos, I was able to come up with two days of instruction where students worked only based upon what they knew and what they did not know about what I'd already taught. My students took an exam after these days of instruction and everyone showed improvement in concepts that I had not previously been able to make any progress in.

—Teacher H

Another teacher reported on how student learning was affected by technology applications:

> I use many different types of technology. My student assessment data proves its effectiveness. Just this week, I gave a math assessment and noticed how well all my students did on a particular short-answer question. I believe one of the major reasons for this was the way I used technology to teach this standard and it also included students using technology to practice the standard.
>
> —Teacher C

One teacher articulated what prompted her to select technology solutions:

> When selecting technology solutions, I consider three factors: ease of use, data management features, and personal benefits as an educator.
>
> **Ease of use.** It needs to be intuitive and fairly easy to navigate. Effective 'help' features that are easy to understand are also important.
>
> **Data management.** Being able to generate reports and analyze data quickly (and easily) is the best tool for determining how instruction needs to be modified!
>
> **Personal benefits.** As an educator, I am always striving to improve. In recent years many things have changed at an incredibly rapid pace (curriculum, assessments, expectations and technology integration. . . just to name a few). Anything that can help me 'keep up' with all the changes and improve as a professional educator is of the utmost importance.
>
> —Teacher B

Month Two: Teachers Begin to See Changed Student Results

In March teachers increased their overall use of technologies, and again found them useful, in general. Several teachers used technology solutions four or more times. They increased their uses of technology for instructional materials for themselves and students. Teachers again reported that they used the recommended and other technologies to assist them in planning differentiated lessons, identifying instructional resources, designing student assessments, analyzing data from the assessments, providing tutorial lessons for students who needed additional assistance, and for their own professional

learning. In fact, teachers' application of technology for professional learning and "improving own or others' skills" increased from zero to four unique uses.

Student engagement. During March teachers reported the following advantages of using technology related to student learning and engagement:

> The use of technology has enabled me to make teaching and learning more engaging. Students see real-life examples, and instruction is more lifelike. Bringing short videos clips into lessons allows students to review outside of class, and also brings a different voice/ perspective into what is being taught.
> —Teacher A

> On LearnZillion I am able to print off results of students and see how they have progressed in a particular subject area. Also, I have used the LearnZillion for English language arts in whole group settings to reteach a concept. The students were able to stay focused on the four short videos that accompanied the lesson.
> —Teacher C

> Using MyMathLab has been great. My students get instant feedback and their homework must be completed with a 100%. I can assign 12 problems and they work them until they are correct. When giving a quiz, which I do often, the students will take the quiz and show all work on paper. The computer will instantly grade it and they will mark their papers and then conference with me. They must show me what they did wrong and explain to me their mistakes. This has been awesome and my students have improved!!
> —Teacher I

> My fifth-period class is filled with a very high number of students who are at risk of not succeeding and posed a unique classroom management challenge. I sought help from the classroom management videos in PD 360 and began implementing some of the strategies the videos suggested. Today that same class has the highest average grade (where they had the second lowest after the first round of quizzes) the students have the highest average attendance, and the fewest students with grades below a C. The strategies suggested were all positive and none of them seemed punitive.
> —Teacher H

Teachers' own learning and use. For several teachers, the technologies contributed to their own professional learning, as teachers reported:

> Technology takes things that were seemingly impossible and makes them everyday. Technology makes handling lots of information easy, and manageable. Videos are much easier than bringing people from miles around to a venue to catch bits and pieces of a speech. Technology saves me time, gas money, and limits. I can watch a video on classroom management whenever I feel like it rather than waiting on the meeting to take place or the PD to become available.
> —Teacher H

> It keeps me searching for the best and most effective way to engage students. PD 360 has really helped me grow as an educator and allows me to control my own learning at my own pace and from the comfort of my own home (even late at night!)
> —Teacher E

> Technology has given me access to a lot of different information. It takes time to look at it but I am always looking for new ways to help my students lean and to make my job easier!
> —Teacher I

> It has definitely made it [my job] easier!! In the past, professional growth relied on attending local and district inservices that provided time to collaborate with colleagues and specialists. It was usually a "one-shot deal" that was limited by our schedules with little or no support or follow up after the training. Social media, professional learning networks and web sites like the Teaching Channel, however, have allowed me to learn more on my own time… any time! Watching videos of sample lessons has been my favorite discovery! Watching lessons online (good and bad) have taught me more than any PD I could have attended! Since the nature of our days prevent us from going into other classrooms, being able to watch videos and connect with colleagues across the world online is truly a benefit for me… as well as my students.
> —Teacher B

At least one teacher clearly articulated the factors considered when evaluating the usefulness of a technology resource: (a) Does it have a knowledge and learning focus? (b) How practical is it? and (c) Will it provide student engagement? Another teacher pointed out that she didn't need as much help in determining how to teach something, rather she liked using programs with combined printable/technology-like materials for student use and assessment purposes.

Policy affects practice. Many of the teachers' answers to the survey questions reflected their enthusiasm for appropriate technological assistance. Teachers noted that getting and keeping students' attention was a big plus, as well as helping the teacher herself learn at an appropriate pace in the comfort of her home. One summed up the benefits of technology as "new ways to help students learn and to make my job easier!"

Enthusiasm about being able to use the technologies, however, was tempered by restrictions on teachers' access to technology. Teachers were caught off-guard by district policies regulating access. In at least one instance, a teacher described great frustration after having spent many hours at home searching for and then planning to use a current electronic resource. In the classroom when she led the students to the identified site, she found her district had blocked it. This raised the question of who makes such decisions, on what criteria they are based, and how often they are re-assessed. Another teacher voiced a related complaint when she said, "School districts buy one system, then other ones are left out; and if they don't get to everything we need, we are stuck with having to look for free or low-cost supplemental materials."

Month Three: Teachers Usage Declines, yet Engagement Deepens

In April teachers' uses tapered off, yet again they found what they accessed to be useful. Usage might have been affected by the statewide annual testing schedule. Teachers continued to cite planning instruction, assessing student learning, and their own professional learning as ongoing purposes for using technology. One teacher spoke of her excitement about having skill assessments and assignments aligned to the state standards available through the various technologies. She noted that this was particularly important as she was working with students to review content in preparation for state assessments.

Teachers model effective use of technologies. A new obstacle cropped up for one middle school teacher: She realized that some students were taking electronic quizzes without having completed the preparatory work or having taken advantage of the guided-practice activities. Because the students had skipped the preliminary steps, they often failed the quiz. The teacher correctly concluded that a resource that was improperly managed might not be a resource at all. She determined that she would model how to watch, stop, practice, and re-start videos so that students could check their understanding. After doing so, she witnessed improved scores on the formative assessments that she created within the technology.

At least one high school teacher found the statewide CIIT System to be unfriendly for high school math content. She viewed it as very difficult for students to use and of "no benefit" to them. She had another technology solution provided by her district that she felt was far more useful because it included content-specific resources appropriate to her students' level of knowledge. Among the pilot group of teachers, however, she was alone in this criticism; the elementary and middle school teachers found the opposite to be true. One teacher regarded the CIIT System as very helpful, in part, because it matched the state assessment language.

Technologies support study and learning for teachers and students. The teachers recognized that they had no causal evidence to demonstrate that the use of technology increased student learning, but more than one teacher commented that students enjoyed using the electronic sites more than they enjoyed, what one teacher referred to as, "sit-and-get" instruction. Using technologies in instructional practices such as conferencing after quizzes, provoked enthusiasm in students and helped them analyze their mistakes with the teacher. Teachers reported seeing student performance improve on different formative assessments after they had used a technology. It might be inferred, then, that the technology had some correlation to increased student learning.

In relationship to the use of technology for their own professional learning on content and pedagogy, one teacher reported advantages while others still found some face-to-face professional learning useful.

Barriers to ease of use. While they were working to find technologies to support student learning, teachers faced certain difficulties, namely Internet connectivity, time to learn, ease of use, and support. One teacher summarized what many others stated:

Time. When learning something new, it's often extremely time consuming to figure out how to use it independently (without any PD) and get comfortable enough with it to implement it effectively with students.

Too many options. There is SO much "out there"! Apps, web sites, social media and Web 2.0 tools are being updated and developed faster than we can imagine! It's hard to keep up with everything and know what's considered "best practice."

Connectivity and equipment. When the network goes down or "slows to a crawl," it's extremely frustrating… and seems to happen frequently. If we are going to be encouraged to use technology with our instruction, connectivity issues may need to be reviewed and addressed. Equipment with inadequate memory and/or outdated software also becomes an obstacle for educators when attempting to use current technological resources.

—Teacher B

As states and districts face increased use of technology for instruction and soon for student assessment, issues related to high-speed Internet access and hardware must be addressed. Interestingly, these two issues related to technology use were evident when technology was first introduced as instructional resources more than two decades ago.

Month Four: Teachers Continue to Seek and Evaluate Appropriate Resources

In May, participants reported that the technologies they accessed were useful, as in past months.

Alignment and data management with statewide system. Teachers mentioned personalizing learning and adding to their instructional materials as the greatest advantages in May. One teacher elaborated, for example, by explaining that with the CIIT System, a teacher can easily develop both multiple choice and open response assessments for her students. She also liked the way the system helps a teacher track data and monitor student achievement.

Resources and connections with peers. Teachers continued to struggle with finding the most relevant resources. One teacher said that when examining software for possible use, for example, it often took "getting far into a lesson before discovering how

deep it is." She said the producers of such resources could help matters immensely if they provided more thorough teacher notes.

At the same time, teachers were finding connections with other teachers through the online technologies. The survey contained several instances where teachers particularly noted the advantage of technology in connecting them with other professionals:

> The resources I have been using have provided me with more ways to present information to my students and develop me professionally by giving me access to other teachers and classrooms doing similar things as me.
> —Teacher H

> It makes me more connected with other teachers all over. It helps me find lesson ideas.
> —Teacher A

In May teachers provided more evidence of how technology supports student learning.

> Roughly 80% of my students were proficient on their final exam for the year. Allowing the review and the final to be in the same format and with the content clarification, the use of technology greatly increased student achievement.
> —Teacher E

> Two math standards were the focus for this time period: Understand and explain equivalent fractions using fraction models and compare fractions by creating common denominators or numerators. [The] spreadsheet shows a progression as students took 2 different quizzes over a span of 3 dates: May 6, 10, and 17. (The May 6 scores represented our first experience with the website, which was less than successful.) It was a pleasure to see that by May 17, a majority of the students had improved their understanding of the website as well as the two math standards! Only two students out of 22 continued to struggle throughout the process. I am confident, however, that with additional guidance, they too would experience success.
> —Teacher B

> [Technology support] provides for individual student enrichment and individual assessment. great for remediation and content review.
> —Teacher G

General Observations From the Study

During the four-month study of selected technologies, participating teachers agreed to use at least two of the suggested technology solutions three or more times. The study also documented their use of any other technology resources they used regularly to support implementation of Kentucky core academic standards. Because the exploratory study focused on teachers' general applications of technology, rather than the technologies themselves, this brief does not specify which technology solutions teachers used most often or which ones they found most beneficial. This report, however, does make general observations about the ways in which teachers used technologies to support their own and student learning.

1. **Differentiation.** With electronic resources, teachers could easily give students different assignments and assessments designed specifically around each student's growth targets. Some of the technologies, incidentally, helped alleviate problems with cheating and/or not doing the work, although not all resources had built-in safeguards against cheating.

2. **Flexibility.** Lessons were easier to adapt with some of the online programs available to teachers. This aspect may help facilitate student conceptual understanding as well as student engagement and motivation.

3. **Diagnosis and intervention.** When student work was done online, teachers were able to receive immediate results and students to get prompt feedback. This immediacy enhanced both the grading process and student learning. Teachers quickly addressed student misconceptions, lack of content background, or need for practice. These advantages meant that students could take the next steps in their learning without waiting for the teacher to grade stacks of papers or for large-scale class assessments to be completed.

4. **Options.** Technology offers many variations on the same lesson. One teacher pointed out that when students did not "get" a concept, rather than repeating the same thing slower and louder, technology allowed for presenting it differently.

5. **Collaboration.** These technologies offered structures and support for student–student and teacher–teacher collaboration. Furthermore, these opportunities were not limited to one classroom or one lesson, but could span time and distance.

6. **Availability.** Participants expressed frustration with a perceived lack of technology resources for high school teachers, but elementary or middle school teachers shared the opposite view. In fact, they said they often felt overwhelmed by a myriad of choices.

7. **Currency.** The teachers regularly confronted issues related to the size and rate of change in the curriculum. In particular, they felt a need to keep up with the appropriate technology resources to ensure student success. And although some technologies helped them identify resources, the participants still consistently expressed fatigue with the amount of time and energy they had to invest to find good resources, then match them to the Common Core standards.

8. **Learning value.** Overall these technologies, by their nature, offered the teachers opportunity to teach in a student-centered fashion. Fewer lessons were "controlled" by the teacher's plan alone, rather they were led by the natural direction the students took as they encountered the online materials.

RECOMMENDATIONS

Given the positive response to the kinds of materials and experiences provided by the ever-increasing wealth of electronic instructional materials, any state, district, school, or teacher may benefit from searching for methods to use, evaluate, and improve these resources. From the views of these teachers, we may derive several suggestions for teachers, schools, districts, and states:

1. With multiple changes occurring in education today, the need and opportunity for collaboration among educators stands out. A growing abundance of online material suggests that a teacher need not have to learn or work alone. Sharing resources and practices is helpful and necessary. Districts and individual schools need plans and structures to help teachers share resources and experience.

2. Ongoing, collaborative assessment and review of results must occur. Just as with non-technological instruction, student results may initially prove to be superficial or short lived. A teacher must constantly find ways to ask if what she is doing works to sustain long-term results. Schools must provide support and structure for dialogue and ongoing professional learning based on the results.

3. Teachers desperately need materials and resources for students' use after school, at home, and elsewhere. Making these resources accessible to students who do not have current technologies available in the home, however, adds another serious challenge. States, districts, and schools must seek ways of providing and maintaining this access.

4. Districts and states must seek flexibility in the materials and resources provided to teachers. Such flexibility allows teachers to differentiate lessons for student skill level, as well to account for rapid changes in information and in technologies themselves. Care needs to be taken when selecting resources, particularly online resources, to ensure they support deep learning and are not, as one high school teacher described them, "silly resources."

5. School and district leaders must provide all teachers with effective professional learning; in doing so, they need also to consider a teacher's need for flexibility, collaboration, and personalization. Currently, many teachers report feeling little guidance or support in tackling standards-driven curricula and creating classroom learning environments that provide for deep implementation of the standards. Education leaders in states, districts and individual schools need to gather and interpret data continually to see what the data tell them about what teachers know and need to know.

CONCLUSION

A middle school teacher (Teacher F) said, "We need to find resources for true application understanding, and assessment. We need to look in new places and search longer for things that produce conversation."

Certainly, this work indicates that evolving educational technologies can offer useful, current, and appealing instructional assistance. Furthermore, they are likely to continue to offer improvement in not only the "what," but the "how," of learning. Conducting further research and facilitating sharing of resources and experiences will help providers hone in on what works in the application of technologies to student and professional learning. As dialogue becomes more critical and better informed, teachers will be able to make professional decisions about technologies and how to use them effectively to prepare 21st-century students for college and career.

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