Preliminary Recommendations Regarding Preparation of Teachers and School Leaders to Use Learning Technologies

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A national symposium on the role of efficacy research in the development, adoption, and implementation of educational technology will take place in 2017. The Educational Technology Efficacy Research symposium represents the culmination of a year-long collaboration among stakeholders: academic researchers, entrepreneurs, school district and university leaders, investors, philanthropists, K-12 teachers, and college professors. This work is motivated by a belief that technology has unmet potential to improve student outcomes. The goal is to move efficacy to the center of the discourse concerning technology in education and, in doing so, create pathways for innovations that work to scale and make an impact. The effort proceeds on the belief that with regard to learning technologies, it is learning that is the primary consideration and most contemporary educational activities involve some kind of technology. The challenge is to determine which uses of various technologies promote learning and improve instruction in a wide variety of circumstances. While learning is always the primary consideration, the secondary consideration is the use of a technology to support learning.
Ten working groups are investigating the role of efficacy research as it relates to (a) K-12 district and school decision making, (b) higher education decision making, (c) research spending, (d) evidence and quality of efficacy in research approaches, (e) institutional competence, (f) investors and entrepreneurs, (g) the role of federal goals and funding, (h) educational philanthropies, (i) end users, and (j) crowdsourcing. The members of Working Group E are investigating the knowledge and competence that faculty members and leaders in educational institutions need to possess with respect to learning technologies in order to prepare competent teachers and school leaders, given the expectation that technologies and societal priorities are likely to change.

The first phase of this effort for Working Group E included interviews with senior faculty members at schools of education that are providing leadership in this area. In addition, parallel interviews were conducted with the director of the U.S. Office of Educational Technology and representatives of several teacher educator associations. Several of these interviews are published in a parallel document as context for the preliminary recommendations outlined below. This work was conducted within the framework of the National Educational Technology Plan (2016a) and the related Educational Technology in Teacher Preparation Policy Brief (2016b).

This work is grounded in the recognition that the context for adoption and use of technology in schools has changed in recent years. The traditional academic model is based on the concept that research on emerging educational innovations will be conducted and subsequently published in peer-reviewed journals. This peer-reviewed research is intended to guide decisions regarding adoption and use of technologies. All too often researchers end up only communicating with other researchers and occasionally with policy makers. Connecting theory, research, practice, and policy making is an important endeavor that is often overlooked.

Disruptive changes are occurring in this model. The decreasing cost of developing some software applications has meant that they are proliferating at a rate faster than academic researchers can review them. Further, the research process and subsequent peer-review typically takes several years. Consequently, research results may no longer be applicable by the time that they are published. In recent years, some journals have accelerated the publication process, and the now-standard rapid development cycle has begun to influence hardware and software development. For instance, rapid prototyping tools such as 3D printers make it easier to design and prototype new hardware and bring it to market. With regard to educational technologies, the emphasis on rapid developments sometimes brings an educational product to market before it is ready or without adequate support for its effective use by teachers. Research is increasingly focusing on studies conducted in actual school settings, but doing so places an increasing burden on schools to try out new technologies and their use in somewhat fixed curricula and often, without attention to specific learner needs.

**Limited Information About the Efficacy of Technology**

As a result, limited objective information is available to guide educators in the selection of available technologies and how they can be effectively used and supported. Awareness is dawning in teacher preparation programs that the paradigm has changed. One faculty member in our interviews commented,

Peer reviewed research will continue to play a very important part in influencing what we know and understand about technology. But the time lag between a research study being conducted, reviewed, published, and being disseminated to the field is far greater than the pace at which new technologies are emerging.
Flipped learning is a good example of this. Teachers were implementing flipped learning paradigms in their classrooms and learning from this practice for several years before the first book on this topic was published. It was even longer before the first peer-reviewed research on this topic was available. We should not ask teachers to wait until the peer-reviewed research becomes available. Once the peer-reviewed research is available, we want teachers to pay attention to it. However, if they wait until definitive research results are available, it will significantly retard advances in the field. In any event, there is no practical way to suppress use of emergent technologies until peer-reviewed research is available.

Although many studies now investigate the uses of a technology and the teacher training, professional development, and ongoing support needed to make effective use of a technology to promote learning, the impact of these research results is problematic. In particular, the dawning recognition of this paradigm shift has not yet been translated into widespread changes in teacher preparation practice. This document is intended as the beginning of a dialog regarding how we might best collectively proceed. We found general agreement among those interviewed that some type of action is required. One faculty member commented,

This is an issue that's really important to me. I remember spending an entire semester in my teacher preparation program learning a technology that was not available in my classroom. I spent an entire semester of my teacher education program learning a technology that I have never used, never will be able to use with my students, and that was out of date within two to three years. As I consider the different institutions in which I have worked, many of them appear to be doing similar things.

On the other hand, many schools are using technologies not available in teacher preparation programs. This comment speaks to the U.S. Office of Educational Technology recommendation that integration of technology in teacher preparation programs should be “program wide and program deep.” In other words, the uses of technology should be incorporated into courses throughout the curriculum in a meaningful way rather than being restricted to a single course.

Institutional Challenges

This goal often gives way to the reality of institutional pressures, however. The director of an elementary education program commented that she agreed that this goal is a good one, but thought that it was impractical in her setting. Her program was attempting to increase enrollment levels by reducing the number of credit hours required. This meant that it was not feasible to incorporate technology in the formal course offerings. In her context, preservice teachers received exposure to technology in their field placements, if at all. The elementary education director noted that while one of the collaborating school divisions made extensive use of technology, the other school divisions in which preservice teachers completed teaching internships did not. Consequently, exposure to technology in this teacher education program is not systemic or reliable. A faculty member in another teacher preparation program reported,

I have talked to our college leadership. They have concerns about the number of topics that must already be covered in the teacher education curriculum. A typical comment is that the curriculum is already packed. There is nowhere to add new content. I can understand their perspective but I also see this as a serious deficit.
Any meaningful plan to prepare teachers to use technology on a wide-scale basis will need to realistically address institutional constraints and pressures. The same is true when it comes to integrating technology effectively within school curricula. Telling preservice and in-service teachers what to do with technology is simply inadequate. Both preservice and in-service teachers need to be shown how to make effective use of a technology and how to determine that their use is, in fact, effective. They need opportunities to practice and evaluate the results of their technology use.

A related issue is the mindset with which technology use is approached. A faculty member commented,

> We have traditionally focused primarily upon technical skills: how to create a website, how to create a blog, how to create a digital portfolio. Some of that is necessary. It is certainly not sufficient. If we are just teaching them skills then we are not teaching them what they are going to need in the classroom. We are also creating an expectation that in order to learn a new technology, they need to take a technical skills course. That is not how it works in the classroom. In the classroom, teachers need to be able to learn things on the fly, they need to teach themselves new technologies as they come out and they need to have a very courageous and adventurous attitude about technology in classrooms.

Again, the emphasis should be on learning and not on a particular technology. Technologies change, so the priority should be on how, why, when, and with whom a particular use of a technology supports learning.

**A Pedagogical Framework**

The faculty member cited in the previous comment believes that it is more important to teach students how they can approach a new technology than to teach any specific skill. A broader issue is the pedagogical framework in which use of technology is embedded. Some teacher preparation programs are moving toward introducing the use of technology in the context of problem-based or project-based learning. Moreover, Shulman (1986) observed that pedagogical understanding as well as content knowledge (PCK) are required for effective instruction. Twenty years later, Mishra and Koehler (2006) argued that this concept is applicable to instructional uses of technology. In other words, technology, pedagogy, and content knowledge (TPACK) are required for effective use of technology in schools. The point is that the components of PCK and TPACK are interrelated and not best treated separately. Separately, these instructional elements are necessary but insufficient to result in the effective use of technology.

Since pedagogical practice varies across disciplines, it follows that best use of technology may also vary across disciplines. The American Association of Colleges of Teacher Education published a landmark work, the AACTE *Handbook of Technological Pedagogical Content Knowledge* (2008), with chapters devoted to pedagogical approaches to the use of technology in different content areas.

One implication of this concept is that technology should be incorporated into pedagogy and content courses rather than covering it in an isolated technology course. Spreadsheets and graphing calculators are an integral part of the math education curriculum, but are less relevant to the social studies curriculum, which may focus on technologies such as use of online primary source documents to facilitate inquiry (for example). It is impractical, therefore, to cover this range of technologies within a single technology course. We also suggest that the emphasis on digital literacy within teacher education programs in some
universities needs to be expanded to include the notion of critical literacy that includes critical reasoning skills and not just a focus on technology.

The concept of TPACK has been cited thousands of times, and has been influential within a narrowly circumscribed circle of faculty members whose professional careers focus on some aspect of emergent technologies. However, the concept is less well known among decision-makers who are responsible for designing the teacher education curriculum. This fact was graphically illustrated by the comments of two deans of education who were invited to participate in a 2016 White House Innovation Summit. These deans were selected to participate because of the reputations that their programs enjoy for technological leadership.

One dean explained that she had integrated Apple technologies throughout the teacher education program. Another dean described her plan for requiring all faculty members to use Google Chromebooks. She reported that one of her faculty members was resistant to this use, but she was confident that she could devise incentives that would lead to 100% participation. When asked if they believed that technology use varies across disciplines, one dean said in surprise, “No, of course not.” The second dean replied, “Why should it?” The assumption that a “one size fits all” preparation to use technology in teacher education is more common than not. Similarly, the director of another teacher education program known for technological leadership was also unfamiliar with the concept of TPACK. The framework within which these institutional leaders view technology has a significant effect on the way in which future teachers are prepared at their institutions.

Preparing Future School Leaders

This lack of understanding regarding the links between technology, pedagogy, and content knowledge also extends to K-12 educational leaders such as superintendents and technology coordinators. One faculty member commented,

The state and national standards for preparation of principals and superintendents have very little to do with technology at the district level and certainly down to the classroom level. There is a serious gap in what principals and superintendents know about what technology is supposed to be able to do in a school. They are not familiar with misconceptions about what technology can and cannot do in schools. Their curriculum focuses on the nature of the job as personnel managers and evaluators and does not focus on specific things like technology. Now, given the amount of money that schools and districts spend on these things I find that to be quite remarkable.

Similarly, central office technology coordinators who make purchasing decisions more often than not are information technology professionals rather than educational technology specialists, although there are some exceptions. In those roles, they are concerned with issues such as software licensing, hardware contracts, and government E-Rate funding initiatives. They are frequently tasked with some type of training or professional development for teachers to use technology. But, they often come from backgrounds where they probably are not aware of evaluations of technology other than perhaps some type of cost comparison or perhaps usability studies. So, they sometimes miss the instructional learning theory component of why something should or should not work well in a school.

These comments were echoed by the chair of a leading educational leadership program. This individual had served in the role of principal and superintendent prior to accepting a university position. She commented,
The technology choices made at the district level do not always meet the needs of teachers. To the extent that this is the case, it may be in part because superintendents and technology coordinators do not always have a good understanding of the way that technologies differ across content areas. Principals are generally not familiar with the way in which use of technologies differ conceptually across content areas. Administrators generally do not have that information. I do not know how you would have the time in the educational leadership curriculum to address each content area individually.

Assessment Literacy

Advances in technology present teacher education programs with challenging issues to consider. There is a foundation of best practice that suggests possible directions for the future. A recurrent theme that emerged is the possibility of preparing teachers to assess learning outcomes in their classrooms. Joseph South, an educational researcher, technology consultant, and former Director of the Office of Educational Technology, suggested,

We need to teach teachers to conduct action research in their own classrooms. They should approach the use of any new tool in this way. This recognizes the reality that ...we do not know what technologies are going to be invented in the future. The chances of teachers having consistently reliable information upon which to make a decision is low. Therefore, we must prepare teachers to make reasoned responses so that they base their choices on evidence.

Another faculty member concurred,

Assessment literacy can help a teacher thrive from day one. Assessment literacy is hard for preservice teachers to develop. Many practicing teachers lack really strong assessment literacy skills. However, this is crucial for areas such as technology. Often peer reviewed research will not appear for several years after a technology becomes available, if at all. What the teachers can do, though, is assess their own students' experiences or uses of the technology.

A department chair concurred with this perspective,

Teachers’ perceptions of technology can be useful: “How easy was it to use?” “Did it resolve the issues they thought it would?” If the teacher doesn’t find it easy to use or solving the problems that they think it should solve, then it is not going to be used in the classroom. We should also consider student use: “What did the students think about it?” “How easy is it for the students to use?” “Does it really make a difference in their learning?”

As a former teacher, I think that teachers’ perceptions of their students is valid evidence that should also be considered. If the students are saying that an innovation is impacting their learning, I don’t know how you can discount that. We should collect and aggregate this data.

A school board will always insist that you would need to look at student achievement data, too. Which is a piece of it, but can't be considered the whole reason why you would adopt or not adopt a certain technology. Even under the best of circumstances, it can be challenging to disaggregate the reasons for shifts in achievement scores and attribute them to a single factor such as technology.
Professional Learning Networks

A network of peers offers a mechanism for aggregating and crowdsourcing teachers' individual assessments of technology. This also offers a support mechanism for ongoing professional development and learning. One faculty member commented,

I like Joseph South’s suggestion of equipping future teachers with a list of questions that they should ask about adoption of any new technology. But we should also link teachers to a sounding board of other teachers in a professional learning network (PLN).

These networks are places where teachers have opportunities to solve immediate problems. They can also further leverage the technology because many teachers who begin using these networks to learn about new technologies or how to problem solve with them later engage in collaborative projects with other teachers. This can lead to co-creation of activities. In some cases, their K-12 students may also begin collaborating as well. Connecting preservice teachers into networks that will still exist beyond their teacher education is a crucial step.

The same could be true for principals and superintendents, who are often even more isolated than teachers. There is only one of them in a school and a few of them in a district. They may even be in competition with the other principals in their districts in some cases. So they also have a strong need to collaborate beyond their school or their district. A professional learning network offers them opportunities to find other districts and principals who have already tried a certain technology, and who have already invested money in it. They can communicate with those principals to ask "What have your experiences been? I see that you’ve just adopted X technology, what’s your experience in your district been?"

Preliminary Recommendations

Going forward, we can make better use of technology in schools by building on existing frameworks and expanding to achieve greater reach and scale in our schools and in our teacher/leader education preparation programs. Existing mechanisms and processes can be used as a starting point. A coalition of teacher educator associations is in the process of developing a series of Technology Competencies for Teacher Educators. A parallel set of standards for superintendents is currently being revisited as well. This is an opportune time to consider goals and objectives to improve our institutional competence. Some preliminary recommendations that might be considered are:

1. Introduce technology in a pedagogical and content-specific context rather than in isolation.
2. Rather than focusing on teaching specific technologies that may quickly become obsolete, prepare teachers to learn how to learn about new technologies that will emerge throughout their professional careers.
3. Equip teachers with the knowledge and skills needed to evaluate learning outcomes associated with use of new technologies.
4. Provide superintendents and principals with a pedagogical framework that allows them to understand how technology use may differ across grade levels and content areas.
5. Connect preservice teachers and future education leaders to professional learning networks that they will continue to use throughout their professional careers.
6. Connect the use of technology with pedagogical approaches in content areas supported by learning science and instructional design findings, such as in the area of project-based learning.

7. Ensure that teacher education and educational leadership faculty members have the requisite knowledge and skills to deliver a curriculum that is consistent with the preceding recommendations.

Summary

One educational leader commented,

If anyone knew how much school districts are spending on technology and how much is sitting in the teachers’ closet, not ever being used, the public would rise up in arms.

Taking the necessary steps to address this need will not be easy or trivial. One respondent commented,

The thing that needs to happen next is the hard work of figuring out how to actually implement the goals that we have outlined. It is easy to say, "Yes, we agree with the idea of making technology program-wide and program-deep." But getting that to actually happen is more complicated.

Many if not most methods faculty believe that the curriculum is already very packed. They wonder, “How could we fit in new topics such as technology integration?” So they are going to view technology as yet another topic added to an already overflowing plate.

Despite the challenges of implementing the reforms suggested, the cost of inaction is greater than the cost of action. Joseph South summed up the challenge in this way:

Schools of education cannot remain on the technological sidelines. In order to make effective use of the enormous national investment in educational technologies, schools of education must prepare future educators to make effective technological decisions. If schools of education are to remain relevant in an increasingly technological future, they must determine how best to do this.

Moreover, American society needs to properly support education at all levels to remain a leader of the world and globally competitive in nearly every domain. A high priority going forward is to systemically and systematically improve learning and instruction at every level in the American education system.

References


Commentary: Response to Preliminary Recommendations Regarding Preparation of Teachers and School Leaders to Use Learning Technologies

Joseph South

I am pleased with its overall tone of the document and the accompanying preliminary recommendations that are presented. The document is thoughtful and thorough. In my view, it illuminates many of the most pressing issues related to educational technology in teacher preparation programs. I appreciate the way in which it preserved the authentic voices of participants throughout.

Reference to externally created and validated educational technology standards is one area in which additional emphasis could be placed. This would be helpful as a reference point for schools of education. The preamble to the numbered recommendations in the current document mentions that they are being updated. The next revision of the document might explicitly state that schools of education should reference these standards and take them into consideration when the teacher preparation curriculum is developed. This is important because it provides a consistent measuring stick that comes from constituents whose first loyalties are to the practitioners who must function in the classroom.

Some excellent work with respect to standards for effective integration of technology in teaching and learning has occurred and is continuing at the present time. Many faculty may not be sure where to begin or what really matters. Technology standards can be both a beacon and a rallying point for change and needed realignment in emphasis and priority. No standard is perfect, but the serious study and consideration of the standards that have been developed should be undertaken by schools of education when they evaluate the degree to which their curriculum accomplishes its intended goals.

Author Note

Joseph South is an educational researcher, technology consultant, and former director of the U.S. Office of Educational Technology. He provided oversight for development of the 2016 National Educational Technology Plan and the related Educational Technology in Teacher Preparation Policy Brief.
Reflections on Preparing Educators to Evaluate the Efficacy of Educational Technology: An Interview With Joseph South

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Abstract

Joseph South, an educational researcher, technology consultant, and former director of the U.S. Office of Educational Technology participated in a research initiative on Educational Technology Efficacy Research organized by the Jefferson Education Accelerator, Digital Promise, and the Curry School of Education at the University of Virginia. The working group in which he participated, one of 10, focused on preparing future teachers and educational leaders to make effective decisions related to evaluation of educational technology products and selection of appropriate technology tools. South responded to interview questions developed by members of Working Group E of the Jefferson Education Accelerator initiative on the Efficacy of Educational Technology Research.

The U.S. Office of Educational Technology convened a Teacher Preparation Innovation Summit in June 2016 with the goal of “Developing a common set of technology competency expectations for university professors and candidates exiting teacher preparation programs for teaching in technologically enabled schools and post-secondary education institutions” (U.S. Department of Education, 2016c). This summit was followed by a related strand at the 2016 National Technology Leadership Summit in September 2016 and culminated in a meeting at the American Association of Colleges of Teacher Education in December, followed by a White House summit on Advancing Educational Technology in Teacher Preparation. The results of this work are summarized in an Education Technology and Teacher Preparation Brief published by the U.S. Department of Education (2016b).
This work was directed by Joseph South, an educational researcher, technology consultant, and former director of the U.S. Office of Educational Technology. In a parallel effort, Joseph South also participated in a research initiative on Educational Technology Efficacy Research organized by the Jefferson Education Accelerator, Digital Promise, and the Curry School of Education at the University of Virginia. The working group in which he participated, one of 10, focused on preparing future teachers and educational leaders to make effective decisions related to evaluation of educational technology products and selection of appropriate technology tools.

The explosion in technological innovation is bringing about disruptive change. An overwhelming number of products are reaching the market. These products outpace the ability of educational researchers to evaluate them. An inadequate amount of trusted information is available about which products are effective. In some ways, the current system has outpaced the ability of teacher education institutions to prepare teachers for a different future.

The working group is soliciting perspectives from deans of education regarding thoughts about how their institutions might best adapt to build capacity for preparing teachers and school leaders for this future. These perspectives will inform recommendations that will be presented at a National Symposium on the Efficacy of Technology in the coming year.

This work is a first step in identifying the ways to enable and facilitate effective use of technologies to improve learning and instruction in American schools. The goal is to establish what is being done in the preparation of teachers and educational leaders and what deans, department chairs and other leaders in the area of preservice training of teachers and school administrators believe might be done differently to improve those programs.

Interview

Joseph South is an educational researcher, technology consultant, and former director of the U.S. Office of Educational Technology. He provided oversight for development of the 2016 National Educational Technology Plan (U.S. Department of Education, 2017) and the related Educational Technology in Teacher Preparation Policy Brief (2017a)

The following interview questions were developed by members of Working Group E of the Jefferson Education Accelerator initiative on the Efficacy of Educational Technology Research, including J. Michael Spector, Kay Persichitte, Ellen Meier, Glen Bull, and Joseph South. The remarks, in the form of an interview with Joseph South conducted in December 2016, have been edited to translate the oral language into a form that best conveys the author’s intent.

1. In what ways do teacher education programs currently prepare future teachers to make appropriate selections of technologies currently available? In what ways do teacher education programs currently prepare teachers to make selections of technologies not yet created and evaluate the impact on learning in their classroom?

My sense is that the majority of teacher education programs are more focused on helping teachers to learn how to use technology tools than on helping them make a good selection about which tools to use. It is not that they think that this is not important. It is just not the focus of their courses.
The orientation of these courses typically is to develop expertise with a set of technology tools. Along the way, there probably are some conversations about why one tool may be better than another or what pedagogy a particular tool might support. However, I would be surprised if there were many schools of education that have a specific objective of trying to increase the expertise of teachers in selecting the right tool for a particular pedagogical goal.

As far as what was they might need to do to accomplish this, I think that schools of education need to have an explicit goal of developing teachers who are savvy consumers of technology. Another educational program, such as a construction management program, might teach students how to select appropriate building materials of high quality. In the same way, we need to prepare future teachers to make appropriate selections of technological tools to address specific pedagogical goals. Future educational leaders – principals and superintendents – need to be able to make these decisions at the district or school level. At the same time, we need to recognize that many teachers make point-of-sale purchases for their classroom. Therefore, teachers also need to be prepared to make effective choices.

We also need to make sure that when we help teachers learn about technology we are very explicit about what pedagogy a particular technology affords. It is equally important to be specific about what pedagogy it does not afford. The first question that teachers should ask when they see a new technology is, “What pedagogy does this technology support?” This should become second nature to them. They should realize that this is their first line of evaluation.

We need to teach teachers to conduct action research in their own classrooms. They should approach the use of any new tool in this way. This recognizes the reality that, as the question above indicates, we do not know what technologies are going to be invented in the future. The chances of teachers having consistently reliable information upon which to make a decision is low. Therefore, we must prepare teachers to make reasoned responses so that they base their choices on evidence. They should know how to collect evidence and how to use that evidence in a defensible way, analyzing it to make informed decisions.

Follow-up question: How do we get at pedagogical uses of technology in the school of education?

That is such a crucial question! Providing teachers with some research-based rubrics may be helpful. My background is in instructional design. Providing teachers with examples of effective practice may also be helpful. This will allow them to see how an expert approaches this problem. This would allow them to see what questions an expert would ask. It may be helpful to equip teachers with a set of meaningful questions to investigate.

I know that we are going to discuss this later in this interview, but teachers often need to know how to evaluate materials that are associated with products that come to them. They need to know that marketing information on a product’s website is often meaningless from a research outcomes point of view. They need to be able to read and evaluate information provided in a white paper. They should know that a white paper that has not undergone peer review may be less rigorous. If a study has been conducted, they need to determine whether the researcher was independent of the company that produced the product. Those are some basic issues that might be addressed.

Another approach – which may be less rigorous but more practical – might be to generate a set of questions to ask a peer or colleague who recommends a technology. We should
prepare teachers to be systematic and reflective before adopting a technology. Preservice teacher should have a basic understanding of learning theory. They should be able to differentiate between behavioral and cognitive approaches. It could be useful to provide teachers with questions about a technology or its uses to help place it theoretically. For example, teachers could learn to situate technologies in terms of student agency. They could also learn how to look for terms that are consistent with the learning sciences as opposed to trending buzzwords of the day.

2. **How do teacher education programs prepare future school leaders (i.e., principals and superintendents) to evaluate technological products or services for district-wide adoption?**

I have not spent a great deal of time reviewing educational leadership programs. Therefore, I do not know what they are currently doing to prepare educational leaders to make effective decisions about adoption of technologies. That said, I have never met the principal or superintendent who told me how well their program prepared them to select technologies.

Therefore, I am going to focus on what I believe is needed in the future. Building on previous comments, educational leaders should be able to create classes of evidence that will allow them to quickly evaluate the materials associated with products. For example, if a $p$-value is provided with the evidence or if a randomized controlled trial has been conducted, that is an indication that there has been a rigorous evaluation. It also indicates that there may be causal data associated with the study.

However, if the study consists of a survey or self-reported data, educational leaders should immediately recognize the study is likely to be less rigorous. This also applies to reports indicating that teachers like a product or adoption data that reports only that teachers continue to use the product. Orienting decision makers in this manner could allow them to quickly triage products under review. Both teachers and educational leaders need a list of questions to ask about technologies that are being evaluated. Some of these questions might be provided to them. Additional questions might be collaboratively developed in teacher preparation and educational leadership programs. These questions should address issues that they should ask vendors about products. There should also be a discussion about how to implement pilot programs for introducing products into school systems. Best practices for doing that should become part of their culture and their expectations.

3. **How do teacher education programs currently prepare future teachers and school leaders to appropriately interpret evidence on the efficacy of technology use?**

Building on previous remarks, one method that comes to mind is the case study methodology. I think that this could be quite effective. A curated set of artifacts could cover an entire spectrum from (a) cases that make unsupported claims to (b) rigorous randomized controlled trials conducted by top researchers. These case studies could be provided along with other course materials. Then on a regular basis – perhaps once a week – they could work through some of the cases.

They could collectively work together to determine whether the claims are valid. They could also identify questions that are not addressed that would need to be asked by the educator were they to consider adoption of a particular technology. The goal would be to get them familiar with this approach to critical thinking.
When I was an undergraduate I took an honors course. They taught students a particular way to read a text – any text. We would ask ourselves, “What are the underlying assumptions of the text? What evidence is brought forth to support the underlying assumptions? Who is the apparent audience of the text? Can you tell if the writer has an agenda?” These are tools of critical thinking and analysis. I can imagine a set of tools being refined and used in education programs to familiarize future leaders with a parallel approach to evaluation.

• **Follow-up question: The utility of case studies is evident but they can be challenging to develop.**

I agree with that. There are at least two types of teaching cases. One kind is the Harvard type of case study. Another type is more similar to what we would call *realia* in language learning. This resembles a sampling of what you might see when you are helping educators think critically about educational materials. This is definitely a significant step down from a Harvard case study, but easier to construct.

Many teacher preparation programs do not ground educators in research methodologies. They often do not learn about research vocabulary. They do not graduate knowing what an effect size is. They do not necessarily know what a t-value means. A *p*-value may or may not mean something to them.

All educational programs have a full curriculum, but I wonder if there might be room to include basic information of this kind in the curriculum. Is this level of rigor that is appropriate for their future roles? To what degree should we expect a teacher to also be a critical assessor of research? If we believe that in today’s rapidly shifting technological climate educators may need this expertise, we should consider how it might be incorporated into the curriculum.

4. **What is your vision for the future as schools of education adapt to a rapidly changing technological environment? In what ways do you feel schools of education will need to change to adapt to a rapidly changing technological environment?**

I believe that schools of education cannot remain on the technological sidelines. In order to make effective use of the enormous national investment in educational technologies, future educators must be prepared by their schools of education to make effective technological decisions. If schools of education are to remain relevant in an increasingly technological future, they must determine how best to do this.

Schools of education must bring technology meaningfully into the practice of preparing teachers to become full-time educators. There should be exemplars of best practice that are not limited to a three-credit technology course. These exemplars should be embedded in their other methodology courses.

In an art course you have the opportunity to try a variety of methods and materials – pastels, and oils, and pen-and-ink. You are given the opportunity to experiment with ceramics and printmaking. We should have a similar mentality in teacher education. Teachers should have the chance to survey and use technologies. They should see a wide variety of technologies used. It would be useful to have an artificial concentration of those technologies in a teacher education program … with the anticipation that using those technologies in an environment in which they can be reflective is going to prepare teachers in a much more impactful way than when they are in an environment with less opportunity
to reflect. Future teachers need to be in programs in which technologies are regularly used by their instructors. This should be an explicit part of teacher education programs.

5. **What are we missing? What else should we be considering as we develop recommendations for building capacity in schools of education for effective preparation of teachers and school leaders?**

One thing that needs to be explored in discussions with deans of education is related to identification of barriers to solutions going forward. We should ask deans and educational leaders, “Can you identify three barriers?” and “Do you have a solution for those barriers?” Including that in future conversations might be helpful.

The pilot interview questions (listed above) are not specific about the points in a degree program that solutions should appear. We should ask whether this should be part of the practical teaching experience. We should also explore what we should expect of the partnership relationships in schools where preservice teachers do their student teaching. We should explore whether there could be a research agenda inside the school. We might also consider how this might relate to promotion criteria for teacher education faculty. I do not work in schools every day, but I hope we will gain useful insights from those who do.

We need to start a national conversation about this. We should convene those working in this area and identify examples of effective practices. We need to start disseminating these examples. I think that the professional organizations affiliated with the National Technology Leadership Coalition can do this, I would like to contribute to the degree that I can be helpful. This is something that is important to me. We are learning who cares about this work. With support from organizations that care about this issue, I believe that we can collectively move this work forward. I would like to give this some consideration, but I believe that this is within reach.

**References**


Commentary: Response of the American Association of Colleges for Teacher Education to “An Interview With Joseph South” Regarding the Preparation of Educators to Evaluate the Efficacy of Educational Technology

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Editors’ Note

The American Association of Colleges of Teacher Education (AACTE) has contributed to significant advances in the field of technology and teacher preparation. AACTE hosts a National Technology Leadership Summit (NTLS) each year that brings together the presidents and leaders of more than a dozen teacher educator associations. The AACTE Committee on Innovation and Technology provided leadership for publication of the AACTE (2008) TPACK Handbook, a seminal work in the field. This year the AACTE’s CEO, Sharon Robinson, will receive the National Technology Leadership Coalition Lifetime Achievement Award on behalf of AACTE in recognition these contributions.

The commentary that follows is a response by members of the AACTE Committee on Innovation and Technology to the remarks by Dr. Joseph South, former Director of the U.S. Department of Education’s Office of Educational Technology, regarding the preparation of educators to use technology. It is preceded by a foreword from Sharon Robinson.
Foreword by Sharon Robinson, AACTE President and CEO

It has been very gratifying to support the rich engagement and productivity of the AACTE standing committee on Innovation and Technology. Members of this committee are diligent and disciplined in their devotion to advancing student learning and advancing knowledge about teaching and learning. Technology becomes a tool for meeting both objectives, as well as the perspective for new questions and challenges. With the release of the 2016 National Educational Technology Plan, titled Future Ready Learning: Reimagining the Role of Technology in Education and the Future Ready Schools Initiative, AACTE members have the opportunity to address a well-articulated agenda for change and its implications for the evolution of educator preparation. Dr. South is correct: New teachers, and indeed all educators, must become well-informed consumers of technology.

Central decisions regarding the acquisition of technology should include input from all stakeholders, including the teachers who will be using these tools. This input will inform policies that ultimately influence student learning. Input should include both policies related to the tools themselves and the interpretation of metrics related to results. Including all stakeholders in the decision-making process will result in better learning outcomes.

Teacher education programs should put the new practitioner on the solid foundation of contemporary theory and practice. New developments in how students learn (neuroscience, cognitive science, pedagogy, and learning theory), rapid advances in technology, and new tools for documenting outcomes can all contribute to enhanced learning outcomes. Future teachers should be given the skills necessary to address new student learning opportunities and understand how to bring new technology developments to learning experiences for the benefit of their students.

And one more thing. Educator preparation programs must help all candidates understand their essential role as advocates for what is best for students – the role of the citizen scholar. The following commentary, by members of the AACTE Committee on Innovation and Technology, in response to the remarks of Joseph South, provides a roadmap for advancing these goals.

Commentary by the AACTE Committee on Innovation and Technology

Disruptive changes are occurring in education through the invention and use of new technologies. Joseph South asserts that teacher preparation programs must respond to these changes in order to remain relevant. We concur.

The Goal

Teacher preparation programs should adopt the goal of making teachers good consumers of research. This should go beyond research related to evaluation of educational technologies. This instruction should be presented in the context of research or evaluation of any type of intervention and any type of instructional methods. Otherwise teachers and school leaders may be influenced by efficacy information about technology that has not undergone peer review. Marketing campaigns can influence decisions in ways that may not meet the needs of schools and their many stakeholders. The goal should not be to make teachers experts in research methods, but to prepare them to investigate claims about
technology. This is especially important for those who are making decisions about the acquisition of technology.

Defining the Problem

Rapid technology change affects both teacher preparation and educational leadership programs. In order to respond to change effectively, the preparation of teachers and educational leaders must be considered together.

Teacher Education. Many teacher education programs do little to prepare teachers to make appropriate selections of technology. Teacher preparation programs typically try to ensure that students graduate knowing some basic technology skills that may, or may not, transfer into the environment and learning context they find in schools. They often will be aware of some web tools and some hardware, like interactive whiteboards. But, seldom in the typical pre-service teacher curriculum do we systematically teach them to make informed choices about technology applications in relation to content and pedagogy. This is a significant shortcoming of many teacher preparation programs.

The teacher preparation curriculum is already densely packed, which makes it challenging to include research and evaluation literacy. Many faculty members also feel that way about incorporating technology in their individual courses. They view technology as yet another topic to be squeezed into a syllabus that is already full, rather than as a natural part of the curriculum. The reaction of some teaching methods professors is, "I can't fit technology into my methods course because I already don't have enough time to do everything I'm trying to do in that course." Beyond individual courses, the leaders of teacher preparation programs often have concerns about the number of topics that must be addressed in the curriculum as a whole. They feel there is not room in the curriculum to address technology in any substantive way. We understand their perspective, but also view this as a serious deficit in teacher preparation. Facilitating the meaningful integration of technology and its evaluation into teacher education programs is a worthwhile issue for the AACTE Committee on Innovation and Technology to pursue.

Educational Leadership. There also is a serious gap in what principals and superintendents know about technology and its effective use in schools. Their preparation curriculum, based on state and national standards, includes very little about technology at the district or classroom levels. It has a limited focus on instructional uses of technology. This is remarkable given the amount of money that schools and districts spend on educational technologies. The research that educational leadership candidates study appears to be primarily from leadership and human resources literature bases. Familiarity with research on meaningful uses of educational technology frequently is missing.

Information technology professionals rather than educational technology specialists often fill the role of technology coordinator. In that role they are concerned with software licensing, hardware contracts, and e-Rate government funding, important activities--but they often preempt and leave little time for coordinators to ensure the professional development of their teachers. Additionally, technology coordinators do not always come from education backgrounds that make them aware of research and evaluation of technology, other than, perhaps, some type of cost comparison. They cannot be counted upon for leadership grounded in education and instructional learning theories relevant to why something may or may not work well in teaching and learning. Ideally the role of information technology and management should be separated from the role of educational technology instructional coach.
The Challenge of Disruptive Change. It will not be sufficient if we only focus on pre-service teachers and what they learn during the two or three years of their teacher preparation programs. If future teachers take a course at the beginning of their program, by the end of the program some of the specific technologies that they would have learned about may no longer be relevant. And certainly by the time they are in the field and have been teaching for two or three years, the technologies available will have changed significantly. The rate of change in technology is so rapid that we have to prepare teachers to continue learning after graduation.

Peer-reviewed research will continue to play an important role in allowing us to understand and use educational technologies effectively, but there is a significant lag between the time that a research study is conducted and published after peer review. New technologies are appearing at a much faster pace than related peer-reviewed research. Teachers need the support of networks that allow them to learn about the successes and problems that other educators are experiencing with technology, and ways in which these problems are being addressed in the field.

Potential Solutions

The work discussed at the U.S. Office of Educational Technology Innovators' Summit in December 2016 was a good first step in defining guidelines for teacher preparation and competencies for teacher educators. These principles are well constructed and should be helpful in moving the field forward. An isolated, single technology course is not sufficient; use of technology needs to be program-wide and program-deep as the principles developed by the U.S. Office of Educational Technology suggest. Now we face the hard work of figuring out how to implement the DOE’s four guiding principles. It is easy to say, “Yes, we agree with the idea of making technology program-wide, program-deep,” but making that actually happen is much more complicated.

College Level Leadership. To support the effort to ensure that the next generation of teachers is prepared, AACTE has developed a TPACK Leadership Diagnostic Tool (2016). This tool is designed to assist deans and their leadership teams to thoughtfully assess current practice and develop action plans to assure teacher candidates are prepared. Critical elements to be considered in the development of programs preparing TPACK-ready pre-service candidates include the vision and policy environment of the teacher preparation program; human and fiscal resources; faculty capacity, time and attention; support of school and other external partners; and the scalability of efforts. The AACTE Committee on Innovation and Technology is conducting research on the use and impact of the tool in a number teacher preparation programs.

Assessment Literacy. With respect to interpretation of evidence on the efficacy of technology use, it may be more important to focus on assessment literacy rather than research methodology literacy in an initial teacher education program. Given infinite hours, it would be great if all teachers knew a fair amount about research methodologies. But, we do not have infinite hours. To help a teacher succeed from day one, assessment literacy may be more fundamental. This can also be the foundation for eventually developing research literacy. Assessment literacy is difficult for teachers to develop. Many practicing teachers lack strong assessment literacy. The topic of assessment literacy leads to issues of reliability, validity, et cetera. That is also relevant to research methodology.

Teachers need to assess their own students' learning outcomes and experiences in relation to the use of the technology. Joseph South comments about teachers not necessarily knowing what an R score means or what a p-value means. In an ideal world, teachers would obtain an initial license and later return for an advanced license. Perhaps in a master's
degree level, there would be time to address research topics more in depth, especially in programs for technology coordinators, teacher leaders, and principals. This, in turn, would support in-service teachers in their decision making. However, in terms of preservice preparation and new teachers thriving on day one, assessment literacy should have the priority.

**Rapid Cycle Evaluation.** The U.S. Office of Educational Technology has developed some tools for rapid cycle evaluation of educational technology. The process and tools could enable school leaders to begin making more informed decisions about the acquisition and use of technology. A second approach may be the development of a checklist or rubric, which would allow a teacher or school to move through a decision tree as they consider educational technologies. It could guide them to think carefully about “What are the instructional goals?” rather than beginning with the features of a specific product as seen in marketing materials. These tools need to be disseminated more broadly, which could possibly be done through selected partnerships, for example between the AACTE Committee on Innovation and Technology and the Office of Educational Technology.

Badging and micro-credentialing may be one solution to the concerns about densely packed teacher preparation curricula. In addition to their use in initial teacher preparation, badges could be used to encourage technology coordinators and in-service teachers to obtain credentials related to the evaluation of educational technology and the meaningful integration of those technologies once they are acquired. Professional learning networks could be important elements of this type of professional development.

**Professional Learning Networks**

Going forward, professional learning networks (PLNs) offer one opportunity for preparing teachers to make selections of technology after they graduate. Connecting future teachers to professional learning networks is a key to ensuring that they will be able to continue adapting to technological change after graduation. These networks can support them and help them understand the implications of emerging technologies.

**PLNs and Classroom Teachers.** Flipped learning was a great example of the way in which learning networks can support adoption of new classroom methods prior to availability of published research. Due to the time lag mentioned before, peer-reviewed research often is not available until several years after the technology appears. Teachers used crowdsourcing to learn about paradigms for flipped classrooms long before published information on these methods was available. Teachers were adopting these methods and implementing them in their classrooms for several years before the first book on flipped classrooms was published. It was even longer before the first peer-reviewed research on these methods was available. Once peer-reviewed research is available, we want teachers to make use of it. However, if they wait until published research is available, they are going to miss significant opportunities.

If we accustom preservice teachers to accessing learning communities during their formative years, they will have the appropriate disposition to make effective use of them after graduation. There are number of different technologies that help teachers access and develop online communities, such as Twitter, Voxer, Facebook, and Edmodo. These online spaces allow teachers to ask questions and receive feedback about emerging technologies.

A professional learning network can provide a sounding board composed of other teachers who can share their use of new tools. Preparing teachers to ask appropriate questions with
respect to selection of technologies is important. But there is also a crucial stage that occurs after the technology is selected. Teachers often encounter problems as they attempt to use new technologies. If you encounter a problem and do not have a way to solve it, use of the technology may not succeed. A teacher can make appropriate selections of technology but fail in instructional implementation if professional support and scaffolding are not adequate.

Learning networks can allow teachers to obtain the support needed to implement new technologies. Teachers who begin using networks to solve technological problems often find opportunities to expand their engagement in collaborative projects with other teachers. They may begin by co-creating a lesson or curriculum unit with another teacher. This often leads to collaboration by their PK-12 students as well.

**PLNs and School Leaders.** The potential value of professional learning networks is applicable to school leaders as well. A number of principals and superintendents make use of these networks. One of the reasons that professional learning networks are attractive to educators is because they allow collaboration beyond their school or district. Historically teachers have been limited in their opportunities to collaborate; typically this extends only to a few people in their school or district. Opportunities to find your tribe and find people who can help you beyond your school can be energizing. That is why busy teachers spend time developing and participating in learning networks.

Principals and superintendents are often even more isolated than teachers, especially in rural areas. There is only one principal in a school and a few principals in a district. They may even be in competition with the other principals in their districts in some ways. So, leaders also have a strong need to collaborate beyond their school or district. This is particularly applicable with respect to evaluation of technological products. A professional learning network offers opportunities to find other districts and principals who have already tried a new technology and invested money in it. They can ask, "What have your experiences been? I see that you've just adopted X technology. What has been the experience in your district? Have you been able to see positive impact on student learning? Collected any data through a rapid evaluation cycle? Found any other related resources or evaluation studies?"

PLNs like this ensure that a technology vendor is not the sole source of information for a school or district. Educator preparation programs can ensure that both teachers and school leaders are experienced in accessing information through professional peer networks by the time they enter the field. Preparation programs can enable candidates to graduate already having a network connection—whether with alumni or other online collaboratives, or through local, state, or national professional associations—where they can access others to enable better informed choices.

**Using Technology Effectively After Adoption**

There is a phase after selection of technology that is crucial: problem solving and adaptation. Teachers often adopt technologies and later realize they are applicable in other contexts. There is a parallel in the pharmaceutical world. Researchers develop a drug to address one illness and subsequently discover that it may be applicable for other uses. Similarly, we can adapt technological tools.

There is a wide spectrum of technologies ranging from very specialized tools to broad systems, including open-ended programs such as Scratch (https://scratch.mit.edu/) around which a number of educational goals can be structured and addressed. If educators
have very specific need, then they look at very specific tools, whereas, if they have broader goals like create, communicate, or collaborate, teachers should consider more open-ended tools such as Scratch.

Affirmation of the value of the adopted technology is essential to comfort level in use and exploration of alternative uses. Affirmation may come through informal reflection on outcomes of P12 student learning, participation in a multi-classroom rapid-cycle evaluation, reinforcement through PLN sharing of experiences and data, and/or review of and comparison with published research.

Summary

Teacher preparation programs across the country have signed on to addressing the challenge of the DOE’s four guiding principles to assure that there is “no uncertainty of whether a learner entering a PK–12 classroom or college lecture hall will encounter a teacher or instructor fully capable of taking advantage of technology to transform learning” (U.S. Department of Education, Office of Educational Technology, 2017, p. 37). Meeting the challenge will require teacher educators, both faculty and administrators, to systematize integration of technology applications for effective content area learning across teacher preparation and leadership programs. Higher education faculty need to hold themselves accountable for careful design of coursework to assure adequate focus on use of current technologies, rather than simply squeezing in a few references to possible uses of technology. In addition, candidates in teacher preparation programs need to gain assessment literacy in support of wise instructional choices, including technology within a TPACK framework. Enhancing candidate knowledge of and initial participation in personal learning networks will further enable their effective use of technology as they transition into full-time teaching roles in schools.

More broadly, stakeholders including AACTE’s Committee on Innovation and Technology and the PLN’s established at the December 2017 DOE Innovation Summit, must work together to address the critical need for enhancing initial teacher preparation programs.

References

