# Role of Federal Funding and Research Findings on Adoption and Implementation of Technology-Based Products and Tools

## WORKING GROUP G TOPIC DESCRIPTION

The federal government has made significant investments in the development, empirical testing, and dissemination of technology-based products for use in education over the past 50+ years. Despite these investments, the extent to which district and school-based personnel actually adopt and use products after grant-sponsored pilot tests end is largely unknown (Yamaguchi & Hall, 2017). What is known is the private sector in the domain of educational technology product development currently spends more money in one year to develop and distribute products than the entirety of government-sponsored research in the past 15 years (Winters, 2015). The members of this working group used the backdrop of federally funded research to examine how school districts and schools make decisions for the purchase, adoption, and continued implementation of technology-based products.

The U.S. Department of Education via the Institute for Education Sciences (IES) and other federal agencies (e.g., NSF) insists grantees use the best possible research methodologies to measure and report the impact of products and technology-inspired pedagogies on student learning outcomes. It can therefore be inferred that if school personnel also insist products they adopt or purchase have strong research backing, that product could have come from a federally-funded source, or may be an attractive product to funding agencies in the future. Our working group conducted a survey of school district or school based personnel. A range of superintendents, assistant superintendents, technology leaders/specialists, principals, assistant principals, instructional coaches, and teachers from 17 U.S. states responded to the online survey. Results demonstrate only 11% of 515 respondents demand a tech-based product have the type of independent, gold-standard research championed by the federal government for funding prior to adoption or purchase. Follow up interviews with decision-making stakeholders from school districts corroborated that the stamp of federal funding and research excellence is desirable, but far from being a deal breaker.

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## PURPOSE OF THE RESEARCH

The purpose of this research study is to gather survey and qualitative data that sheds light on the extent to which school district personnel make high quality research evidence (the type prioritized by the federal government when awarding grants) part of their decision-making processes for purchasing, adopting and implementing technology-based products. University faculty and other scholars who receive grant funds, primarily through the U.S. Department of Education, are generally not entrepreneurs, and are at risk of dropping lines of inquiry related to technology products when funding for a specific project ends. While the government does have competitions that allow businesses to compete for grant dollars (e.g., SBIR), and has mechanisms through ESSA for districts and schools to access federal dollars for technology implementation (Office of Educational Technology, 2017), the lion's share of the available grant funds in this domain go to university or agency-based researchers. Investments in products and projects are made, results are achieved, but the results rarely reach the ears of key decision-makers in schools. Why?

To an academic, dissemination of a project's findings generally includes writing articles for peer-reviewed journals, presenting at conferences, and hopefully having the product reviewed and included by the What Works Clearinghouse website (https://ies.ed.gov/ncee/wwc/). While part of the typical process needed to reach milestones within universities (e.g., tenure, promotion, etc.), and secure additional funding, these modest approaches to dissemination are unlikely to result in substantial adoption in schools. In fact, federal funding is not seen by most academics as a pathway to creation of one's own business. Instead, funding is lifeblood for getting an idea off the ground and testing the efficacy of that idea, and is a means to an end: To perpetually seek additional means to support additional research. In other words, most academics are happy being academics, and are not interested in or even capable of becoming entrepreneurs. This reality in our field is not a pure negative, the research community creating products that are backed by high quality research is essential. That said, if scientific findings cannot be translated into practices and tools that reach a wide audience of potential users, the value of the investment of time and resources can be called into question.

This reality is the greatest strength is also the greatest weakness in terms of federal expenditures for research in the domain of educational technology. The strength lies in that researchers are commissioned to use the very best research designs and methodologies to evaluate the efficacy of a product or products without substantial

worry about bias, error, or impropriety. Also, when the US Department of Education makes a grant, there is compelling evidence in place that the idea for or existing product being developed and/or tested is grounded in appropriate theory. However, these strengths are also weaknesses. For example, high quality research takes a significant amount of time and resources. The research cycle of developing an idea, piloting that idea, conducting formal tests, writing results for publication, and going through the publication cycle can take an extraordinarily long amount of time – literally years in some cases (Culatta & Stevens, 2015). The pace of technology development in the private sector is far more nimble and responsive to the needs of the marketplace (Digital Promise, 2014). Therefore, by the time a product funded by the government has gone through its traditional cycle of academic research and dissemination, the product may well already be outdated, or incapable of supplanting a product a district already purchased. In sum, ideas and significant amounts of time and money go into products that never reach a broad audience because that is not what academics are generally set up to do.

By shedding light on how district and school based personnel make decisions regarding the purchase and adoption of technology-based products, we aim to further expose the rift between federal expenditures for research and development, and how business is generally conducted in schools. It is our intent that our findings and recommendations help the Department of Education and university-based grantees rethink its approach to the research and development cycle for technology development.

## BACKGROUND AND LITERATURE REVIEW

The federal government has made investments in educational technology by way of research grants made through the Institute for Education Sciences (IES). A recent compendium report by Yamaguchi and Hall (2017) on behalf of IES describes over 400 grants made to researchers between 2002 and 2014 to develop, test, and disseminate technology-based pedagogies, practices, tools, games, and programs intended to support a range of learning and behavioral outcomes for students. These projects yielded more than 270 web-based tools, 85 virtual environments and interactive simulations, 95 intelligent tutor and artificial intelligence software systems, 50 game-based tools, and 105 computer-based assessments. These various products and tools are spread across numerous purposes, and are often highly specific given the aims of the research team.

Although far from insignificant, these results are also not overwhelming. Despite these (and other) federal investments, there is evidence to suggest a gap between the products that emerge from funded research projects and widespread adoption in schools. Our survey and interviews shed some light on this gap. In addition, the amount of non-federal investments in technology development for any one year dwarfs the total federal investment made in technology-related research (Devlin, 2015). Further, those private investments are not targeted to develop research-backed products intended to reach K-12 students within schools. One reason is the shrinking budgets of schools and corresponding inability to make large purchases. Therefore, school leaders are left with a mixed marketplace of technology-related products with a small amount developed by researchers using federal dollars, and the lion's share coming from technology start-ups, entrepreneurs, and other companies seeking profit.

The Student Support and Academic Enrichment (SSAE) program is the primary

source for educational technology funding in ESSA. The funds allocated by Congress for this program (split among well-rounded educational opportunities, safe and healthy students, and supporting the effective use of technology) are at risk of being cut under the Trump Administration and Republican-led Congress (Technology for Education Consortium, 2017). This means, it is highly likely that schools will have even less money provided by the government to spend on technology products, implementation, and professional development. Currently, technology's slice under the SSAE program for infrastructure expenditures is 15% of remaining dollars after 20% is spent on each of safe and healthy students and well-rounded educational opportunities. The remaining 45% can be spent by LEAs in any way they see fit, including not spending money in one or more of the three domains. It is also possible that SSAE will be completely eliminated. Either way, it seems likely that districts and schools will have less money to use on technology infrastructure, products, and professional development, which will further exasperate the issues noted above and throughout this report.

## HYPOTHESES

Our main hypothesis was that district and school based personnel make decisions for purchasing and adopting technology-based products for their schools based on variables that prioritize the existence of independent, peer-reviewed research. Because the federal government has and continues to play an important role in helping researchers develop and bring new technology-related products and tools to life, it is logical to expect school-based personnel to honor those investments, and actively seek them out as top choices for use in schools.

## CURRENT STUDY

To evaluate the accuracy of our hypothesis, we developed the following research questions: 1) To what extent do district/school based personnel prioritize high quality research evidence when making decisions regarding purchase/adoption of technology-based products for use in schools? 2) What factors are important to decision-makers when selecting technology-based products? 3) Do decision-makers explicitly seek to determine if a product is the result of federal funding?

## METHODOLOGY & PARTICIPANTS

Members of the research team wrote survey items and qualitative research questions. The items were written as an outgrowth of the group's discussions. The items focused on how school district based personnel make purchasing and adoption decisions regarding technology related tools and products. In addition, we focused on how those decisions are (or are not) informed by federal funding. The major domains of exploration include 1) Research's role in decision making; 2) Usability features; and 3) Issues related to implementation. The specific questions and corresponding data are noted in Appendix A.

Items were reviewed by a team of four experts for conceptual coherence, and piloted with possible respondents for overall clarity. The experts and pilot respondents provided comments that led to revisions. The survey was created within the Qualtrics online platform. The link to complete the survey was disseminated to potential

respondents via members of our working group, on social media (e.g., Facebook and Twitter), on discussion boards for professionals in the field (e.g., Reddit), and via personal invitations to colleagues of group members. It is not possible to calculate a response rate given this dissemination strategy; however, as noted below, the number and distribution of respondents from a range of U.S. locations and job settings is approximately representative of the nation.

Our survey has 515 completed surveys. About 24% are district tech supervisors, 22% are assistant superintendents, 7% superintendents, 27% are teachers, 10% are principals. 47% work primarily in the District Office, 18% work across schools, 13% are in a middle school, 12% are in a high school, 10% work primarily in an Elementary School. The respondents come from Urban (31%), Suburban (26%), Rural (23%) and Mixed Districts (20%). 76% of respondents are directly involved or consulted regarding technology purchasing decisions. 24% report not having any say – they are all teachers.

For qualitative interviews, the Research Lead conducted two semi-structured interviews with key technology decision-makers for two school districts. The participants had 15 and 22 years of experience, respectively, and each spent time rising through the ranks as classroom teachers, principals, and district office leaders. Participant 1 came from a mixed district (blend of suburban and rural schools) in a Mid-Atlantic state of approximately 5,000 students. Participant 2 hails from a rural district of approximately 2,000 students in a Mid-Atlantic state. Interviews were transcribed and coded prior to analyses. The interviewees were volunteers. At the end of the online survey, participants were invited to note their contact information if they were willing to be interviewed. The researcher selected the two participants based on their proximity to his university given limited time and resources to complete interviews. Thus, it is possible other respondents drawn from other locations would have offered substantially different responses than those recorded. The interview protocol is listed at the end of Appendix A.

## FINDINGS & INSIGHTS

**Survey Results**

A table of results from the full set of survey items is available as Appendix A following this report. We asked survey respondents: ***When making purchasing and/or adoption decisions regarding a new technology-based product (assume for academic instruction) for your district or school, how important is the existence of peer-reviewed research to back the product?*** Only 11% said they would not buy or adopt a program if peer-reviewed research was absent. Another 41% say strong consideration is given to whether peer-reviewed research is present, 41% say this is considered, but not key, and the remaining 7% say they will purchase/adopt products without strong research. Thus, almost 90% of respondents to our survey do not insist a research backing be in place prior to adoption/purchase and implementation, and nearly half either pay lip service or do not care if research is in place.

A follow up question asked if the decision-making team takes into account where the peer-reviewed research was published (in terms of being a journal they read/have heard of). No one said they would not make a purchase if the research appeared in a journal they were not familiar with. 24% of respondents give the quality of the journal

strong consideration, 35% consider the location, but is not key, and 41% will purchase regardless of the journal where the research appears. These findings, when considered together, demonstrate a surprising trend on the part of practitioners to not insist technology products be backed by research, and appear in visible journals – which implies the quality of the research to be high. This could be a reason why the technology marketplace is flooded with tools that are not backed by research – schools will buy products without evidence.

Survey respondents were asked the extent to which if the research backing the product/tool was conducted by the research team was critical for their adoption/purchasing decisions. Only 3% demand research be completed independent from the developer, and 49% strongly consider this information in decision-making. A similar question asked respondents about the extent to which "gold standard research designs" (e.g., use of randomized control trials) are important when evaluating the effectiveness of a product/tool. 8% insist on gold-standard research designs before making a purchasing/adoption decision, and 38% strongly consider whether or not research using the best available quantitative design was used. This offers further corroborating evidence that school-based personnel are just as likely to purchase/adopt technology regardless of where it comes from, and if it is supported by the kind of research insisted upon by the Federal Government (e.g., IES).

By way of comparison, 38% say the cost of a product is extremely important, and another 19% say the cost is very important. 38% say the extent to which the product fits within existing district initiatives or products is extremely important and 27% more say the fit is very important. These data provide additional data to corroborate our major finding, that school-based personnel are making decisions based on local conveniences and perceived needs, and not giving the same weight to the existence of high quality, peer-reviewed research that flows from grant dollars awarded by the federal government.

**Interview Results**

In the interviews, neither respondent said they pay particular attention to whether or not a product was funded by federal dollars. One said, "If the product was developed using federal grant dollars, great, but the more important factor is the extent to which it suits our needs." The other said, "Features and functionality are what I look for. Endorsement from the feds is nice icing on the cake – But cake still tastes pretty good with or without that icing." When considering these quotes in light of survey data, and other available reports/publications on this topic, these takes are not surprising: Many school-based personnel prioritize perceived functionality over proven results.

Interviewees were asked if push came to shove, is our hypothesis correct that functionality and fit are more important to their decision making than the presence and quality of research evidence – Both said yes if they were pinned down and had to make a choice. That said, neither said research evidence was unimportant – in fact, both said they definitely look for and carefully consider research evidence.

## IMPLICATIONS & RECOMMENDATIONS

**RESEARCHERS**

Researchers play a key role in using their time and skills to conduct careful examinations of the efficacy of technology-based products to improve student learning and other outcomes. The government recently has introduced a "low-cost, short duration" funding program that may be ideal for ed tech research. Although it is difficult to conduct high quality research quickly and on the cheap when an intervention is involved, our field must respond to the fact that our results are often irrelevant by the time they reach the pages of our academic journals. In addition, researchers should aim to form limited partnerships with companies creating technology products, with the intent of conducting independent research studies to validate new ideas. Finally, researchers should be more conscious about translating their research into venues that practitioners can access and understand.

It is seemingly important that Universities determine pathways towards giving faculty credit (for promotion, tenure, and annual merit raises) for research activities involving non-traditional explorations and disseminations involving educational technology. Typically, faculty are rewarded for creating new ideas, and carrying those ideas through the research and development cycle. Less emphasis is placed on conducting tests of others' products and disseminating those findings to the field. Both are critical research activities, but conducting tests of others' products is for some reason seen as a lessor contribution. In addition, publications of data-based articles in peer-reviewed journals is the coin of the realm for professors at many top research-intensive universities. Other important dissemination activities, such as presentations, webinars, practitioner-oriented articles, and other meetings are not valued as highly, despite their outsize impact on the field. In other words, the activities researchers are given the most reward for are usually the least consumed by the broad field.

**ED TECH ENTREPRENEURS**

Ed tech entrepreneurs can take several important lessons away from our findings. The first implication is an open secret in this field: Districts and schools will buy products without any or much research evidence. While this unfortunate fact provides little incentive for entrepreneurs to spend precious resources collecting efficacy data, they should still make it a priority. The government has several programs, such as SBIR, where companies can partner with researchers to obtain funding to develop and test a new product. Entrepreneurs are encouraged to actively seek partnerships with researchers and school districts to conduct tests of their product(s). To do so is in the common interest of the field and student well-being. Entrepreneurs can also participate in a proposed "rating system" for technology-based products based on how much research evidence exists to support the tool. Products with more evidence would have higher scores, and those created and tested using funds from the government would have the highest scores.

At minimum, ed tech developers and entrepreneurs should ensure their products are grounded in appropriate theory, and contain elements that can be pointed to as being evidence-based. Doing so will help the field better understand the genesis of new products, even when experimental trials are not available.

**FUNDERS**

The federal government should be proud of its investments in educational technology. Numerous products and projects have yielded outcomes that have and continue to help students and teachers succeed. That being said, traditional research grants in this domain may be ripe for new thinking that is more in line with the pace of change in this field. Continuing the short-duration, low cost programs that have recently arisen is a good starting place. Making investments directly to states and districts through ESSA funds that allow districts to conduct their own tests of products and/or partner with researchers or product developers will also be positive in terms of creating desirable outcomes. Hopefully Congress will not vote to end SSAE funding that LEAs use to purchase and implement technology hardware and software. If they do, or even if funding is reduced, schools will have an even harder time adopting high quality technology.

A key idea for funders is to establish research programs that provide funds for researchers to conduct evaluations of others' existing products. If resources are made available, and university rewards systems can be modified, scholars will answer the bell in terms of using their precious time to explore impact of products on student learning and other achievement. Without resources earmarked explicitly for this purpose, however, we as a field are unlikely to gain traction.

**PRACTITIONERS**

Practitioners should continue to demand that technology-based products they are considering for purchase or adoption be supported by at least some high-quality research. One way this can happen is by opening their doors to researchers and companies seeking partners and laboratories for piloting new ideas and products. Practitioners can also vote with their feet in terms of pledging (and following through) to not purchase or adopt products that are not backed by sufficient research evidence. If a critical mass of practitioners made this switch, instead of buying products based on immediate need and convenience, the marketplace would indeed make needed adjustments.

**POLICYMAKERS**

Policymakers should make a point of emphasis that districts and schools should either be required, or strongly encouraged to purchase/adopt products that are grounded in strong empirical research. In addition, keeping the pressure on the Administration and members of Congress to allocate sufficient resources to support research and implementation in the domain of educational technology is also critical.

## UNANSWERED QUESTIONS & NEXT STEPS

Our field needs a paradigm shift in terms of how schools should insist that developers actually test their products prior to purchase. However, there is a dilemma of having limited time and funds to support student needs and there isn't patience to do research – just need to make the best decisions that we can. One idea is to build credibility for products with some sort of universal scoring system based on how much evidence it has, that consumers could look to when making purchasing or adoption decisions. Products created using funding from the government and tested using high quality research methods would have a higher score. But many products now funded by the feds are small scale research studies, and once they end the researchers never take it to scale because they aren't entrepreneurs and don't have the resources or know how to move beyond the original scope of the funded project. Industry does not have that issue, but they have really limited incentive to do research when they can sell their product without it.

**Appendix A:**
**Working Group G Research Report**

Our Group has 515 completed surveys. About 24% are district tech supervisors, 22% are assistant superintendents, 7% superintendents, 27% are teachers, 10% are principals.

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76% of respondents are directly involved or consulted regarding technology purchasing decisions. 24% report not having any say – they are all teachers.

**Data from Survey**
(***note: because of rounded decimals may not add up to exactly 100%***)

| | **Not Considered** | **OK if Missing** | **Considered But Not Key** | **Given Strong Consideration** | **Would Not Buy if Absent** |
|---|---|---|---|---|---|
| ***When making purchasing and/or adoption decisions regarding a new technology-based product (assume for academic instruction) for your district or school, how important is:*** | | | | | |
| Existence of Peer Reviewed Research to Back Product | 5% | 2% | 41% | 41% | 11% |
| Peer reviewed research is easily accessible on product website | 3% | 19% | 42% | 32% | 3% |
| Peer reviewed research appears in journal you have heard of | 27% | 14% | 35% | 24% | 0% |
| Existence of other, non-peer reviewed research | 19% | 16% | 54% | 11% | 0% |

| | Not Considered | OK if Missing | Considered But Not Key | Given Strong Consideration | Would Not Buy if Absent |
|---|---|---|---|---|---|
| Non-peer reviewed research is easily accessible | 16% | 35% | 26% | 23% | 0% |
| The research was conducted independent from research team | 11% | 19% | 19% | 49% | 3% |
| Students in the Studies are comparable to students in your district | 8% | 5% | 27% | 57% | 3% |
| Published research uses gold-standard methods | 11% | 16% | 27% | 38% | 8% |
| Published research reports satisfaction data from students & teachers | 8% | 11% | 19% | 51% | 11% |
| Program is customizable | 3% | 3% | 19% | 55% | 19% |
| Data output is Accessible | 3% | 0% | 16% | 52% | 29% |
| Data output from program and existing data systems for school/district are interoperable | 6% | 6% | 32% | 35% | 19% |
| Product has single sign on capability | 9% | 9% | 35% | 39% | 6% |

| | Not Considered | OK if Missing | Considered But Not Key | Given Strong Consideration | Would Not Buy if Absent |
|---|---|---|---|---|---|
| Product can be used by a range of grade/ age levels | 3% | 3% | 19% | 71% | 3% |
| Customizable privacy options | 6% | 3% | 26% | 48% | 16% |
| Implementation support is available | 3% | 9% | 26% | 48% | 13% |
| Product developed w/input from teachers | 6% | 3% | 35% | 48% | 6% |
| Product developed w/input from students | 10% | 3% | 52% | 29% | 6% |
| Product is a best Seller | 10% | 6% | 55% | 29% | 0% |
| Website is easy to navigate | 10% | 3% | 39% | 45% | 3% |
| Website has Testimonials | 13% | 6% | 61% | 19% | 0% |
| Product is highly rated by customers | 6% | 6% | 61% | 26% | 0% |
| Product is Useful for students w/disabilities | 3% | 0% | 13% | 68% | 16% |
| Product is useful for English Language Learners | 6% | 0% | 16% | 71% | 6% |

**When evaluating the technology tool or product for use in your school/district setting, how important is:**

| | Not at all Important | Slightly Important | Moderately Important | Very Important | Extremely Important |
|---|---|---|---|---|---|
| Ease of Implementation | 8% | 11% | 11% | 32% | 38% |
| Time required to Maintain product | 8% | 11% | 11% | 43% | 27% |
| Time needed to train teachers/staff to use | 11% | 3% | 22% | 30% | 35% |
| Product cost | 11% | 8% | 24% | 19% | 38% |
| Conduct needs Assessment to determine need | 8% | 27% | 24% | 22% | 19% |
| How product fits within existing district initiatives or products | 8% | 11% | 16% | 27% | 38% |

**Survey Protocol**

Talk to me about how you and your district make decisions regarding technology adoption and purchasing. Follow up.

To what extent does a product being backed by federal research dollars influence your decision making? Follow up.

Is our hypothesis correct that functionality and fit are more important to decision making than the presence and quality of research evidence? Explain