From the Market to the Classroom:

How Ed-tech Products are Procured by School Districts Interacting with Vendors

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Abstract. School districts are adopting educational technology products at an increasing rate over the years. As more and more products become available, school districts face the challenge of identifying and evaluating programs to meet students' needs, while ed-tech providers compete for access to decision makers. The present mixed methods study sought to document the process by which school districts discover, evaluate, and acquire ed-tech products and how vendors market and work through this process with districts. Participants included district stakeholders representing 54 school districts and vendors from 47 ed-tech companies. Results indicated that, in contrast to best practices, needs assessments were rarely, if at all conducted, districts and vendors lack a central source of information for product information and evidence of effectiveness, and decisions are often made on small-scale pilot tryouts, peer references, and less often by examining rigorous evaluation evidence. Based on these findings, we offer recommendations for both district and vendor stakeholders to encourage successful procurement of ed-tech products.

For over three decades, schools have endeavored to improve student achievement through the introduction of desktop and laptop computers, tablets, and other digital and technology tools. While the "computer revolution" long ago predicted by Bork (1987) has been much slower to evolve than originally envisioned, technology is now proliferating at an exponential rate in school districts nationally while spurring the globalization of social and business   communications and economic transactions (Herald, 2016).

Exemplifying federal efforts toward these goals is the National Education Technology Plan (NETP), designed to scale innovative practices in the use of technology in teaching and learning and bring existing and emerging technology innovations into schools (U.S. Department of Education, 2010). The NTEP was actuated at the heels of the 2009 American Recovery and Reinvestment Act (ARRA). This one-time source of funds intended to ensure that every student is technologically literate by the end of eighth grade and that teacher training and curriculum development included successful research-based instructional methods related to technology integration (U.S. Department of Education, 2009). As a general rationale for the present study, realizing these goals depends on schools being aware of and able to obtain and implement effective educational technology ("ed-tech") products.

Given the ever-increasing focus on ed-tech product acquisition across the United States, this study sought to explore how procurement practices operate within school districts. As educators must decide amongst a multitude of options that may (or may not) meet the needs of their students. As the following sections present, there is a dearth of research regarding how such decisions are made.

Selecting and Integrating Technology: Many Choices and Few Guidelines

Although raising student achievement is the primary focus for both federal and individual school initiatives, inserting technology into the classroom is not a solution in and of itself

(Cheung & Slavin, 2011; 2012; Morrison, 1994). As has been argued cogently by educational

technology researchers and theorists such as Richard Clark (1983), it is *not* the technology that

affects student learning, but rather the instructional strategies and lesson content that technology

affords or delivers (Knowlton, 1964; Salomon & Clark, 1977).

Today, the rapidly changing landscape in the wake of many states' adoption of Common

Core State Standards (Common Core State Standards Initiative, 2010a, 2010b) and the recent

passage by the U.S. Congress of the Every Student Succeeds Act (ESSA), has spurred the

proliferation of ed-tech products to support classroom teaching, assessment, and data

management. In 2017, the investments made to ed-tech companies substantially exceeded those

of any prior year, reaching $9.52 billion compared to $2.42 billion in 2014 and $1.64 billion in

2013 (Adkins, 2018). With so many products reaching the market, practitioners and procurement

officials face a weighty and challenging responsibility of deciding which ones to purchase (e.g.,

Dyrli, 2007; Levy, 2013). Prior research, however, on how such determinations are made is

limited and seriously dated. The dearth of research evidence from both consumer (school

district) and vendor perspectives created both a rationale for and specific questions to be

addressed by the present comprehensive study of the procurement of ed-tech products.

Roles and Preparedness of the Key Stakeholders

The stakes in selecting ed-tech products are considerable given scarce resources (budgets

and staff time) and the pressures on every school to demonstrate high student achievement.

Literature on consumer theory, while not addressing the unique organizational, political, and

bureaucratic structures of school districts' procurement processes further reflects frequent

inconsistencies between how consumers actually act in making selections and how they should

act given environmental factors (Gowdy & Mayumi, 2001) and psychological behaviors (Thaler,

1980). The Technology Acceptance Model (TAM) further explains the influences of being both

a user and shopper of technology on increasing potential to return to consumer websites and

make unplanned purchases (Koufaris, 2002). In a school district procurement situation, TAM

effects could operate more as a collective group function given that solo or unilateral purchases

are rare.

Logically, given factors related to both consumerism in general and school district

procurement operations, engaging key consumer stakeholders, such as teachers, administrators,

and parents, in dialogue with each other and vendors seems strategic to ensure that the purchased

products meet student and district needs (Burch & Good, 2015; Dexter, 2008). Discouragingly,

however, prior research suggests very limited teacher involvement in the procurement of

educational products. As experts have long observed, however, the involvement of end-users in

the decision-making process fosters successful implementation of an intervention (Ely, 1990;

Fullan, 1985).

Administrator roles also come into play. In the 1990's, when interest in technology was

beginning to burgeon in schools, Radlick (1998) noted that superintendents were largely

withdrawn from procurement discussions, suggesting the risk of "grassroots" decisions being

made in the absence of broader strategic planning. However, concerns have been raised about

principals lacking instructional technology (IT) leadership skills sharing IT decisions with often

similarly inexperienced teachers and other staff (Dexter, 2008; Flanagan & Jacobson, 2003). The

rapid growth of ed-tech products can only exacerbate the frustration and confusion with

developing viable school-wide and classroom-based IT plans.

These challenges potentially elevate the role of chief technology officers (CTOs) within

school districts (The Consortium for School Networking, 2015). Among the specific skill areas

targeted for these specialists are planning for meaningful and effective uses of technology; leveraging appropriate relationships between emerging technology resources and the education processes; developing and maintaining a systemic understanding of the core business and culture of the school organization; and working with key system leaders, people networks, and/or learning communities (e.g., mathematics teachers) and departments to identify steps needed to meet strategic goals. Accordingly, CTOs, more than superintendents, curriculum directors, and principals, might assume primary roles in selecting and acquiring ed-tech products.

Frameworks for Acquiring and Integrating Technology

Anthony (2012) invokes "activity theory" to interpret how a school district values and distributes technology leadership. Activity theory examines communities as social and cultural groups with explicit rules or social norms that regulate and influence behavior (Engeström, 1987; Leont'ev, 1978). As system participants engage in an activity, tasks and responsibilities are shared (Cole & Engeström, 1993). Within this framework, implementing technology in schools is achieved through teachers' and leaders' involvement in at least two activity systems: (a) complementary technology planning by district administrators and technology leaders, and (b) technology integration carried out by classroom teachers. Importantly, the nature and frequency of teachers' technology use mirrors the compatibility of the administrator and practitioner dynamics (Anthony, 2012).

A district's level of success in acquiring and implementing technology similarly is predicted by Rogers' (2003) Diffusion of Innovation Theory. Here, each prospective user progresses through a five-stage process when deciding whether to adopt an innovation. The *knowledge stage* occurs when the potential adopter learns about the innovation's existence. Second, during the *persuasion stage*, the potential adopter forms either a favorable or an

unfavorable opinion about the innovation. Third, in the *decision stage*, the potential adopter

decides whether to adopt the innovation. Fourth, during the *implementation stage*, the innovation

is put into operation. Fifth, in the *confirmation stage*, the adopter either reaffirms or rejects the

decision to adopt the innovation. Rogers (2003) also notes the importance of (a) the innovation's

attributes, (b) the type of innovation-decision, (c) communication channels, (d) the nature of the

social system, and (e) the promotion efforts made by change agents in determining the rate of

adoption.

In organizational settings, these stages evolve through the dynamics and norms of the

social system affected by the adoption of the innovation. According to Ashley (2009), diffusion

theory emphasizes the following roles of two types of intermediaries, the change agent and the

opinion leader:

The change agent creates or enhances demand for an innovation by reducing barriers and

convincing potential adopters that the innovation is a sufficient fit. In this role, the change

agent serves as the bridge between the technical experts or group that created the

innovation and the target audience. Opinion leaders are early adopters of an innovation

who, by their own adoption, improve the likelihood of adoption among their peers and

work in the process to persuade the middle and late adopters of an innovation (p. 39).

These ideas seem logical and reflective of typical processes identified in prior research

for adopting innovations. However, as new and established ed-tech products flood the current

market, questions arise about decision-making processes for procuring them in school districts

with multiple stakeholders, prescribed purchasing policies, and limited budgets. That is, does

procurement in school districts proceed in orderly and inclusive ways? Are technology directors

and procurement officers more involved than superintendents, principals, and other

administrators or practitioners? To what degree is evidence of effectiveness used in making decisions? These and the additional research questions presented below prompted the present descriptive and correlational study of the experiences and perspectives of representatives from a large national sample school districts and from vendors of ed-tech products for whom those districts are the major customers. In this study, our focus was on student-facing ed-tech products that are used for either core or supplementary instruction.

Procurement "Action-Point" Framework

The operational framework for the present study (see Figure 1) emerged from the forgoing literature and a preliminary study in which we conducted four webinar-based focus groups with target stakeholders of ed-tech product procurement. The volunteer participants were recruited by Digital Promise and the Education Industries Association from various membership groups and professional contacts. Included in each focus group of 7-10 individuals were ed-tech vendors, superintendents, principals, district ed-tech directors, teachers, direct procurement officers, and members of organizations involved in various ed-tech domains.

The emergent framework includes five key "*Action Points*" of typical procurement processes in school districts. These Action Points are interactive and often overlapping rather than an invariant linear sequence. For present purposes, they relate research questions and potentially associated results to key procurement needs that occur at one time or another along the pathway from the allotment of funding to the acquisition of selected products.

Figure 1. Operational framework for ed-tech procurement.

Action Point I: Allotment of Funding. The amount of funding available to purchase ed- tech products directly influences the scope of the product search and the degree of participant involvement in subsequent phases.

Action Point II: Assessment of Needs. Using this component, school districts identify where and how ed-tech support is needed, so that the search for products (Action Point III) has direction and purpose.

Action Point III: Discovery of Ed-tech Products. This component exposes school districts to a variety of ed-tech products that perform different educational functions, thus, creating opportunity to further investigate those appearing to offer the best fit.

Action Point IV: Evaluation of Product Quality and Effectiveness. Based on evidence about the product, peer recommendations, demonstrations, or "pilots", school districts make judgments about products' potential to support instructional needs and goals.

Action Point V: Acquisition of Selected Products. In this culminating activity, the products selected are acquired through completed purchasing agreements with the vendors. The processes involved may be quite straightforward and rapidly completed or may be complicated and slowed by district (e.g., school board) or external (state or municipal) policies.

Based on the above framework and the lack of current research on ed-tech procurement processes, gaps, and needs, the present study was designed to address the following research questions:

1. What does the K-12 ed-tech procurement process look like for district and vendor stakeholders?

   a. What are stakeholders' levels of satisfaction with the process?

   b. What sources of information are used for decision-making?

      c.   Who is involved in the decision making process?

2.   What are the constraining conditions (i.e. obstacles) that do or could get in the way of an efficient ed-tech procurement process?

3.   What are the enabling factors (i.e. best practices) that do or could facilitate an efficient ed-tech procurement process?

4.   What adjustments in the ed-tech procurement process do participants believe would improve efficiency in acquiring needed products?

Method

The current study employed a convergent parallel design as described by Creswell and Plano Clark (2011). As such, we implemented quantitative and qualitative strands of the research study concurrently. In our study, quantitative and qualitative data had equal priority in examining the processes by which school districts discover, evaluate, and acquire ed-tech products. Perspectives from multiple district stakeholder groups and ed-tech program vendors were obtained through surveys and individual interviews (Flick, 2014). To explore possible differences in how the stakeholder groups reacted, we further conducted statistical comparisons between groups. This mixed-methods approach allowed for the confirmation and triangulation of findings, resulting in increased validity and robust support for conclusions (Denzin, 1989).

Participants

The 335 participants consisted of representatives from K-12 school districts and from ed-tech companies. The latter were recruited based on membership in various professional organizations such as the American Association for School Administrators (AASA), the League of Innovative Schools through Digital Promise, the State Educational Technology Directors Association, and the Education Industry Association. We asked the primary contact at each

organization to provide the names and email addresses of other target participants within their

district. An email was sent to each of these potential participants explaining the purpose of the

research study and inviting them to participate. A total of 420 district and vendor contacts received

invitations to participate in the research study and 335 completed the survey for a reasonably high

79.8% response rate.

District sample. The 288 district participants included superintendents ($n = 42$),

curriculum directors ($n = 43$), business officers ($n = 41$), technology directors ($n = 59$), and

principals ($n = 103$) representing 54 school districts in 31 states. The districts had an average

student enrollment of 21,090.53 students ($SD = 28,699.08$). Most (37%) of these districts enrolled

between 2,000 and 9,999 students and 20% enrolled 10,000 to 19,999 students.

Ed-tech vendor sample. The 47 ed-tech vendor participants came from a range of ed- tech

companies offering personalized learning programs to school districts. Example programs included

an e-book reading application, multimedia content with embedded assessments, and   adaptive

electronic textbooks. The majority (43%) of ed-tech companies had been in business for two to

five years, followed by 11 to 15 years (19%), and then more than 20 years (17%).

Instruments

Surveys. The survey instrument was comprised of three components. The first included 30

Likert-type scale items, which were presented to all participants (see Appendix Table A.1). These

questions were informed by Rogers (2003) diffusion of innovation theory that describes   the

importance of innovation attributes, types of innovation-decisions, and communication   channels.

Questions focused on such topics as perceptions of the procurement process, sources of

information for evaluating products, stakeholder involvement in procurement, financial factors,

challenges and enabling factors, and potential tools and information to improve procurement.

Participants responded using a five-point scale (e.g., 1= strongly disagree to 5 = strongly agree). Second, we asked three open-ended items, asking participants to identify and describe practices that appear to work best for acquiring quality products, main challenges or barriers experienced, and what, if any, improvements in the procurement process would be most beneficial in bringing quality products to end users. The third component included an additional 8 to 22 Likert-type items and several open-ended questions tailored to respondents' roles.

Because our literature search failed to identify any validated survey instruments on procuring ed-tech products, we developed and validated the present surveys using a systematic process. Specifically, we drafted initial sets of items which were initially reviewed by senior colleagues from Digital Promise and The Education Industry Association. A revised version of the items were presented to a Technical Advisory Group (TAG) consisting of 23 school administrators and ed-tech vendors for review and feedback. Additional versions of items were subjected to TAG review until consensually supported final versions emerged. These were then field-tested with volunteer respondents. This iterative process of drafting and receiving feedback helped ensure the survey items would support meaningful analyses and, ultimately, useful conclusions for ed-tech vendors and school districts. Cronbach's alpha reliability computed on the 48 common items asked of the majority of survey respondents yielded a moderate to high index of 0.77. Cronbach's alpha reliability computed on the various sections of the survey yielded indices of .75 for perceptions of the process, .63 for information sources, .81 for stakeholder involvement, and .87 for perceived helpfulness of tools and potential solutions.

Interviews. Core and role-specific interview questions were designed to allow participants to elaborate on emerging themes from survey data (Flick, 1992; Rubin & Rubin, 2012). Sample questions included (a) to what degree and how are end users (students, teachers, and principals)

involved, and (b) what new tools, guidelines, or information would be most helpful to your district for improving the ed-tech procurement process. Role-specific questions, for example, asked business officers whether products that bundle the software and hardware have any competitive advantage; superintendents and business officers if data privacy or security concerns affect their selection or purchase of products; and ed-tech vendors to explain the processes typically involved in selling ed-tech products to school districts.

Procedures

Participants were informed that their responses were voluntary and anonymous. They also were asked their willingness to participate in an interview upon completing the survey. A stratified random sample of interviewees was composed to ensure representation from various sizes of districts and vendors. Interviews were conducted with superintendents ($n = 9$), curriculum directors ($n = 6$), business officers ($n = 10$), technology directors ($n = 9$), principals ($n = 9$), and vendors ($n = 10$). Trained interviewers conducted each interview using a structured interview guide. Each interview lasted between 60-90 minutes and were conducted over a period of one month.

Analysis

For examining differences between stakeholder groups, we conducted analysis of variance (ANOVA) omnibus tests on the survey responses. We followed up significant differences with post hoc tests using a Bonferroni adjustment for multiple comparisons.

Members of the research team transcribed all interviews within one week of the day of the interview. Completed transcripts were uploaded immediately to Nvivo (QRS International) for storage and analysis. Two members of the research team coded each transcript. The dyad team began each analytic session by reading through the transcript and discussing themes. In the

beginning stages of analysis, dyads worked essentially from scratch to develop codes, relying on

consensus establish by discussion between and across dyad teams. Eventually, a codebook

emerged. The codebook was adjusted as codes were merged, split, created and dissolved as new

transcripts were added to the project. This iterative process of coding and analysis, and the

feedback loop established between data analysis and data collection is best described as grounded

theory method (Glaser & Strauss, 1967).

After we completed all 53 interviews, we reviewed each code individually for internal

consistency and uniqueness. The coding scheme was organized hierarchically, such that broad

themes were comprised of sub-codes and sub-sub-codes, which provided increasingly nuanced

information.

Results

We present results in this section by research question. We begin with survey results and

interview findings pertaining to how stakeholders described the ed-tech procurement process and

their degree of satisfaction with the process. The second section presents results regarding what

information sources are used by stakeholders when Discovering ("Action Point III") and

Evaluating ("Action Point IV") ed-tech products. The third section describes the involvement of

district- and school-level stakeholders throughout the ed-tech procurement process. The next two

sections present findings pertaining to the constraining conditions and obstacles to procurement,

along with the factors that facilitate an efficient and effective process. The results section

concludes with results regarding participants' suggested changes to improve the process.

Of 53 comparisons of surveys responses between stakeholders, 27 were statistically

significant (see Table A1 in the Appendix). The following narrative highlights those items with

significant differences and other interesting results as gathered through the survey and interview responses.

Description of and Satisfaction with the Ed-tech Procurement Process

Survey data were gathered to examine the degree to which stakeholders were evaluated with the overall process of ed-tech procurement. Then, participants described their process for ed-tech procurement during interviews.

Ed-tech products and instruction. A key question in this study concerned the degree to which different stakeholder groups were satisfied with the procurement process for "identifying, evaluating, and acquiring needed ed-tech products" (survey item 1). There was a statistically significant difference between groups, $F(5, 329) = 25.926$, $p < .001$, with each district group indicating significantly higher satisfaction than vendors. District participants overall (68.8%) were satisfied or very satisfied, while vendors (65.9%) tended to be dissatisfied very dissatisfied. No district group differed from any other. We also explored satisfaction with the process at the school level. While district participants overall were satisfied or very satisfied (59.4%), there was a significant difference between groups $F(2, 199) = 4.078$, $p < .001$. Principals were significantly more satisfied (64.1% at least satisfied) than curriculum directors (50.0%). Principals likewise were generally satisfied (61.2%) with processes at the classroom level.

Two thirds of district participants indicated they were mostly satisfied with the success of typical purchasing decisions in obtaining products to meet specifically identified instructional needs. Though differences between groups were not significant, superintendents were the most likely to agree (76.2% at least agreed) and principals were least likely (61.2%). On a separate item, vendors were neutral (42.6% at least agreed) regarding their understanding of districts' instructional needs and preferred pedagogies.

Interviews with district participants revealed somewhat varied approaches to the discovery, evaluation, and acquisition of ed-tech products (see Table 1). Contrary to expected practices, few interviewees ($n = 9$) referenced that a need was first identified. The majority of these ($n = 7$) were vague regarding a needs assessment, such as a curriculum director who commented, "We really wanted to have a variety of platforms to cover the different academic areas. We started with a need." In contrast, two participants described examining student achievement data, whether at the school level or district level, to establish a need. The remaining district participants ($n = 36$) described the primary determinant of discovery as exposure to a product, whether through an active search, a teacher or school suggestion to central office staff, or peer recommendations. Few ($n = 2$) referenced the use of a Request for Proposals (RFP) to discover programs that might fit the identified needs. Participants then often described an evaluation stage in which stakeholders further reviewed or interacted with the product.

Table 1.

Themes from District Participants' Interviews Regarding Procurement Processes

Identification of Need	Discovery	Evaluation
District or school goals Student data	Conferences Active searching Vendor marketing or outreach End-user or school suggestion to central office Peer recommendations Proposals submitted in response to an RFP	Technology committee review Curriculum department review Product demonstration Pilot

The majority ($n = 4$) of vendors indicated that their outreach to school districts began with cold calls or emails, whereas three noted they instead focused on contacting teachers. Lesser-used means were customer referrals ($n = 1$) and conferences ($n = 2$).

Information Sources for Identifying, Selecting, and Acquiring Products

Survey data provided insight into participants' reliance on various sources of information to identify, select, and ultimately acquire ed-tech products. Although survey responses by district participants' indicated relying most frequently on pilot tryouts within the district (92.0% at least moderate reliance), there were significant differences between groups, F (5, 328) = 5.164, $p <$ .001. Post hoc analyses revealed that superintendents reported a significantly greater reliance on pilot tryouts (100% at least moderate reliance) as compared with business officers (80.5%), and vendors (78.7%). For all groups, the next strongest information sources were rigorous (81.1%) and non-rigorous (67.9%) evaluation evidence.

In contrast, vendors believed to a significantly greater extent than all district groups, $F(5, 328) = 5.921$, $p < .001$, that districts most strongly relied on non-rigorous evaluation evidence (85.1% at least moderate). They also conveyed, as did district respondents, high district reliance on pilot tryouts (78.7%), and rigorous evaluation evidence (81.1%).

It is noteworthy that just under half (47.6%) of district participants indicated being at least somewhat satisfied with the credibility of product evidence submitted by vendors. However, participant groups significantly differed in their response, $F(4, 281) = 4.082$, $p < .01$, with post hoc analyses revealing higher satisfaction with product evidence by principals (57.8% at least somewhat satisfied) than technology directors (30.5%).

Regarding evidence sources, survey results show greater reliance by district stakeholders on end-users (principals and teachers) and peers or consultants than on websites or sales representatives. Group comparisons, $F(5, 327) = 3.828$, $p < .01$, indicated that superintendents had significantly higher reliance (100% at least moderate) on end user recommendations than did technology directors (91.5%) and principals (87.4%). Curriculum directors perceived little

reliance by others on their own recommendations (37.5% at least moderate), whereas technology

directors were confident that their own recommendations were followed (71.2%).

Vendors generally viewed recommendations from sales representatives as slightly more

influential as did district participants overall (74.5% vs, 64.1% at least moderate). Vendors   viewed

their recommendations significantly more influential than business officers (92.7% at   least

moderate) and principals (90.2%) indicated reliance on vendor recommendations, $F(5, 325)$

$= 4.563, p < .001$. Nearly all vendors (95.7%) also perceived districts to rely on product

recommendations from other districts or consultants.

During interviews, participants were asked what information is utilized when making

decisions regarding acquisition of ed-tech products. The common themes in district participants'

responses consisted of peer references ($n = 14$), research or evidence of effectiveness ($n = 11$),

pilot tryouts ($n = 10$), and expert review ($n = 4$). In contrast, vendors ($n = 8$) most frequently

indicated that product features most often distinguished their products from those of competitors.

A minority ($n = 2$) noted evidence of effectiveness or pilots as influential. We discuss these

responses below.

References. In viewing references as a critical source of information, interview participants

noted that they either would ask the vendor for current users or would consult with   neighboring

districts regarding their opinions and experiences with products. Some saw references as having

particularly high importance ("I'd say the best types of evidence are the educator experiences in

other districts") while others used references along with other sources of   information. A small

number of participants explained that they wanted to hear experiences   specifically from districts

similar to their own in size or student demographics. However, a small number of interviewees

noted some skepticism with references. For example, a business officer   commented,

"In every bid or every RFP we do, we ask for references. Let's be honest. When you give me a reference, it's going to be someone who's fallen madly in love with me and is going to give me a good reference."

Evidence of effectiveness. As the next most frequently referenced theme for sources of information, district interviewees described requesting evidence from vendors demonstrating results, such as that available form a vendor's white paper, or research publications. As a Superintendent commented,

> … if a vendor had some third party evaluative data -- and some I've worked with do and have shared it. That's nice - they make for a great talking points for my role if I'm making a recommendation to the board for a purchase.

A business officer noted,

> So we look to see that the companies that are producing data that shows us that the students that have utilized their software have seen growth and achievement. If they have not, then it's a waste of everybody's time, so that's our first step.

> One vendor indicated that evidence of effectiveness was a key selling point: "We're willing to guarantee student achievement gains. And not only just guarantee that, but we have really clear results on student efficacy." In contrast, another noted that while they had conducted an efficacy study, the evidence of effectiveness was not valued by districts they had worked with.

Some district interviewees (*n* = 8) presented an alternate, skeptical view on evidence of effectiveness. The majority indicated either not trusting research produced by the vendor or believing evidence for ed-tech products to be limited. As a curriculum director observed,

So many of these products and services don't have independent research conducted on them. You can find something positive to say about any product that's out there. So you really have to be careful between marketing materials and research materials. I have not found a lot of well-conducted research done on too many products.

An education technology director expressed a preference for references, alluding to "a general   skepticism about the reliability of educational technology research." Similarly, a curriculum   director offered, "Yeah, we want to see what kind of results they get, but almost all those vendors can produce results. I've never seen one that can't yet."

Pilot tryouts. Interviewees also referenced pilot tryouts by their teachers and staff as a frequent and valuable source of evidence. For example, an educational technology director commented, "Demonstrations and pilot projects… if we can get a demo version of the product and evaluate it in our own context, on our own systems, with our own students, that also tends to be more persuasive." Another noted a heavily reliance on pilots, offering

We're forcing companies to do a pilot test with us, at no cost, to come in and put this in several of our schools and let it run for six or eight months and then I get feedback. I'll sit down with [the principals and teachers], without the vendor there, and I want a full honest answer.

With one exception, all interviewees indicated that pilots were used to some degree. The typical mode is an informal trial with a small number of teachers to gather feedback in a fairly short duration (e.g., less than two months). Only three interviewees referenced gathering student

achievement data or evidence of effectiveness. A small number ($n = 4$) of district participants

noted that pilots allow them to obtain first-hand knowledge of what a full-scale implementation

may look like. As an educational technology director commented, "We love to do the pilots and it

gives us a real world flavor of how this is going to work for us, and what the challenges could be if

we decide to do something as a district."

As with district interviewees, all vendors indicated that they participate in pilots, though

the majority ($n = 6$) described this evaluation as more of a demonstration. Several indicated that

the free trials offered to teachers were part of a marketing strategy to encourage broader school- or

district-level adoption. Overall, vendors were very positive towards trials and pilots. One vendor

acutely observed,

> .. it's impossible really to sell without a demo, because people need to understand what it is
>
> they're buying. Then we're excited about the opportunity to pilot our products in schools
>
> and really show what it can do. … because it's such a risk adverse industry, [it] has very
>
> few buyers who are willing to stick their necks out and try something. It sort of inhibits
>
> innovation in some way at scale. So pilots are a way to provide a little bit more clarity and
>
> hopefully explanation for why it was a good choice to go with the vendor you went with
>
> because hey, it worked in this space.

Expert review. A small number of interviewees noted use of a committee to evaluate

products. As described by one superintendent,

> It's instructional team members and also technology team members, and school-based and
>
> district-based. Quarterly, I think, is when they're meeting, when vendors will come and do
>
> a presentation, and then we have a rubric that we use to assess that product and

determine, and then this committee will recommend the products that they think we ought

to consider using.

Product features. According to vendors, the defining aspect that leads to the selection of

their product centered on product features, such as compatibility with existing hardware or

platforms in use, professional development and ongoing support offered to users, and ease of use.

Stakeholder Involvement

A key question in this study sought to understand the involvement of different stakeholders

in the ed-tech procurement process. We begin this section with the presentation of survey findings

related to central office involvement and school-level stakeholder involvement.   Then, we review

survey and interview findings related to communications between stakeholders.

Central office involvement. When asked which central office staff were most involved in

procurement, respondents overall identified educational technology directors (99.3% at least

moderately involved), curriculum directors (96.1%), and superintendents (87.0%). In comparison

analyses, the technology director's involvement, $F(5) = 17.113$, $p < .001$, was perceived as

significantly higher by each of the district groups than by vendors. Other significant effects

indicated varied cases where a particular respondent group viewed stakeholder involvement

differently than other group (see Table A.1). Exemplary findings are (a) most district groups

perceiving more involvement by the chief financial officer, $F(5, 317) = 4.410$, $p < .001$, than did

vendors, (b) technology directors perceiving more involvement by the chief information officer,

$F(5, 270) = 9.122$, $p < .001$, than by most other groups, (c) business officers perceiving chief

purchasing officers, $F(5, 285) = 2.497$, $p < .05$ as more involved than did vendors, and (d)

principals perceiving the school board, $F(5, 317) = 4.247$, $p < .001$, as more involved than did vendors.

School stakeholder involvement. Across all respondents, principals (90.9% at least moderately involved) and teachers (83.2%) were viewed as most involved, followed by students (43.5%), and then parents (24.1%). Comparative analyses indicated that technology directors viewed a significantly greater student involvement (50.8% at least moderately involved) than vendors (24.4%), $F(5, 318) = 3.135$, $p < .01$. Relatedly, participants differed in their satisfaction with end-user involvement in the selection and acquisition of products, $F(5, 328) = 2.938$, $p <$ .05. Superintendents were significantly more satisfied (71.4% at least somewhat) than were vendors (31.9%).

During interviews, district participants indicated that the involvement of end-users was predominantly during evaluation of products ($n = 34$), but also in discovering products suggested for school or district acquisition ($n = 13$). Rarely ($n = 2$) did district interviewees comment on end-user involvement in a needs assessment. Regarding personal involvement in evaluation of products, interviewees most frequently referenced participation on a technology committee, along with central office stakeholders, who would review potential products for acquisition.

Some also referenced participating in trials or pilots. Several vendors ($n = 3$) noted that their outreach efforts would begin with teachers and principals in order to gain visibility within a district.

Regarding the importance of end-user involvement in procurement, a principal commented, "I think the teacher involvement is critical. They're the people who are to use these for students and with students. They know the students and our clients, for lack of a better term, better than anyone else." Similarly, a business officer offered

I think it has to be a top-to-bottom/bottom-to-top type of process… So I think that if it's a partnership, and the teachers, and the principals, and the administrators at the campuses feel like the curriculum and instruction people are listening to what their requirements are and what their needs are, and also are understanding that the curriculum and instruction people are reacting to things like state requirements and Common Core, and all these other things that they have to pay attention to.

While in many districts, schools had the ability to acquire supplementary products with their own funds, district administrators indicated that a lack of involvement from central office could result in inequities across schools, issues with operating system or hardware compatibility, and the potential for products to be acquired that serve identical purposes as those acquired at the district level.

Communication. District participants reported mostly positive feelings of satisfaction (58.5% at least somewhat satisfied) with the communications between various district stakeholders regarding products to address specific instructional needs. On the other hand, vendors indicated in surveys they were mostly dissatisfied (55.3%) with their ability to gain acceptance or visibility within a district and were even less satisfied (59.6% at least somewhat dissatisfied) with respect to their access to district decision makers regarding the procurement process.

Some interviewees noted the importance of collaboration between stakeholders, recognizing that, for example, a curriculum director might focus on the instructional aspect of ed-tech, whereas a technology director would examine ed-tech from a compatibility perspective. Most participants reported that communications between district administrators and schools are

positive and important, particularly as teachers and principals are directly involved with

classrooms where products are ultimately implemented.

Constraining Conditions and Obstacles

Beyond understand the ed-tech procurement process including information sources and

stakeholder involvement, we were interested in the specific challenges that both district and   vendor

stakeholders encounter. Survey and interview data revealed that challenges and impeding   practices

for procurement revolved around resources, issues with discovery and evaluation, and   aspects of

the purchasing process. These are discussed in the following sections.

Resources. The most frequent challenge expressed in survey responses ($n = 182$) and in

interviews ($n = 12$) related to insufficient resources, specifically for funding and infrastructure to

implement acquired educational technology programs. District participants referenced the cost of

items, as well as reductions in the technology budgets for school districts. For example, a

superintendent commented the, "cost of the items is a number one concern," while another noted

that the, "tech budget is 50% less than six years ago." An educational technology director

commented that, "as with most districts, the needs typically outweigh the funds available."

Vendors also referenced funding and financial concerns. One vendor noted, "Relationship selling

requires direct sales force, expensive to scale." District participants also described the challenge   of

ensuring schools had the necessary infrastructure, such as reliable Internet.

Discovery challenges. Identifying products from the many available to meet an

instructional need, was a common theme in survey responses ($n = 73$) and interviews ($n = 8$). For

example, a superintendent noted the, "constant changes in technology," while another referenced

the, "challenge of keeping up with latest technologies because it changes so rapidly." A   technology

director commented, "it is impossible to be aware of every piece of valuable

educational software," while a superintendent stated that the "quantity of vendors is both a blessing and a curse." Further, a business officer equated the growing number of ed-tech options to the ".com explosion."

Vendors also commented on the "overwhelming amount of products on the marketplace," the difficulties of districts' gaining awareness of their product. For example, one vendor noted the lack of a means to identify districts that might be receptive to their products. Another commented on the difficulty of "getting in front of the right people initially," due to the company's lack of brand recognition and recognized that districts "don't have the time to evaluate all programs out there."

Evaluation of products. The evaluation of ed tech products as potential solutions was a common theme for participants in survey responses ($n = 45$) and interviews ($n = 4$). District participants referenced the lack of credible research and information about products, as well as the challenge of effectively evaluating products within the district through pilots or trials. A superintendent commented, "It's kind of difficult to ascertain those software programs that are good." But, a vendor said,

> It would be nice if that [efficacy research] was a marketing feature for us since we have
>
> that, but it's also kind of unfortunate for our education system that there's a lot of stuff
>
> being bought based on the brochure, I think, and not enough rigor there.

Purchasing process. In survey responses, vendors ($n = 20$) reported the greatest challenge of the purchasing process to entail responding to RFPs, buying cycles, and a lack of understanding for districts' procurement processes. Challenges specific to purchasing were also referenced in interviews by both groups ($n = 9$). Concerns with RFPs included, "RFPs that are specifically created to be exclusionary", and that a "district may not understand what's needed to

meet their own objective, so RFPs may not be clear enough to determine whether we're a good fit or not." Vendors struggled with understanding the procurement practices within districts, such as, "lack of communication regarding the buying process," and being, "unaware of their procurement activities." Further, in interviews, vendors described the challenge of responding to RFPs, such as the time, effort, and human capital required to develop a proposal specifically crafted for each.

What Factors Facilitate Procurement?

In addition to exploring the challenges districts face, we gathered survey and interview data to better understand the practices that facilitate an efficient and effective ed-tech procurement process. In an open-ended survey item and in interviews of district participants, the predominant themes for best practices included conducting pilots and trials, involving end-users, learning from peers, conducting a needs assessment, and using more formal processes such as RFPs and obtaining bids. Vendors spoke to the need for districts to have a clear vision and process supporting ed-tech product acquisition.

Pilots and Trials. Survey respondents ($n = 123$) and interview participants ($n = 5$) viewed pilots and trials as important evaluation practices. For example, a superintendent noted a best practice was to, "identify a pilot population with interested participants, define criteria for pilot success and negotiate the pilot with vendor." Another superintendent indicated in an interview, "if we're going to do anything it has to be piloted… we won't make a larger purchase unless it has been tested by [teachers] at the classroom level first." Further, a principal noted the use of, "high quality teachers piloting products under guidance of the building principal." Vendors also noted the importance of pilots in gaining entry; one noted, "[We] run a small pilot program in one school in the district then ask for introduction."

End-user involvement. Beyond the more specific reference to participating in pilots and trials, the broad theme of end-user involvement was frequently referenced in survey responses ($n = 76$) and interviews ($n = 7$). Here, participants described teachers' reviews of products, discovering products that may be considered for district adoption, school-level acquisition of products, or participating in an evaluation. A minority ($n = 3$) referenced teacher participation in a needs assessment. There was an acute observation offered by a superintendent: "We engage stakeholders in the decision, so that the technology purchased will be implemented well."

Involvement of end-users was most often referenced in terms of a technology committee that consists of teachers, principals, and district administrators. A business officer noted the value of, "putting together committees or task forces so everyone has a voice," and a principal commented on, "making the decision with input from all sides, as a group, as collaboratively as possible." Vendors also described how teacher and principal feedback enabled an efficient process and encouraged ultimate buy-in once products were purchased.

Learning from peers. A common theme in survey responses ($n = 89$) was the value and frequency of using other districts as references for product selection. These learning opportunities spoke to discovery of products ("discussion with other districts about the effective use or non-effective use of technology") as well as for evaluation of products ("contact with other school districts using the ed-tech product for feedback, visit, and recommendations").

Needs assessment. The importance of beginning the discovery of ed tech products and later evaluation of products with an instructional need was referenced in survey responses ($n = 75$) and in a few ($n = 3$) interviews. An educational technology director stated that the best practice is to, "purchase products that solve a specific problem or meet a specific need." In addition, a vendor mentioned that need assessments, "help educate districts early in their

evaluation process about what is possible to ensure their complete needs are clearly articulated and met."

   Formal purchasing processes. A frequent theme in survey responses ($n = 66$) and some ($n = 9$) interviews was the use of formal processes, such as Request for Proposals (RFPs), "piggybacking" (expedited RFPs based on another district's proposal), and sole source contracts. Improved RFPs might involve careful consideration for product features and desires, such as a business officer noting the use of, "RFP/Bidding with detailed product requirements." Further, the RFPs "allow you to define the selection criteria to achieve the best value rather than lowest bid" as noted by another business officer. Participants also noted in interviews that the current RFP process enabled a competitive evaluation of ed-tech vendors.

What Changes in Procurement are Recommended?

   Our last research question sought to understand what changes districts and vendors might make to improve the procurement process. A series of survey items asked district and vendor participants to rate their perceived level of helpfulness for specific tools and resources. We also included an open-ended survey question for participants to offer suggested recommendations. Last, we asked district participants to what advice they might offer to vendors to improve relationships.

   Needs to improve ed-tech procurement. When asked on the survey to rate the degree to which specific tools and information would be helpful for improving the procurement process, district participants were most favorable toward guidelines for conducting pilot studies and for pilot best practices (94.4% at least moderately helpful for both), and standard evaluation rubrics for judging the quality of products.

The predominant theme in district participants' open-ended survey responses ($n = 149$) and interviews ($n = 20$) was a central source or national website with product information and reviews. District participants viewed such a website as a potentially valuable resource for obtaining information about products, experiences of other districts using products, and a general means of learning about the ed-tech products available to them. They expressed the desire for independent reviews, third party evaluations of products, and a resource to compare all of the available products in one location. This source was also supported by vendors' survey responses ($n = 12$) and interview comments ($n = 2$).

Additional themes in surveys responses included support for purchasing ed-tech products ($n = 47$), such as standard contracts and a means for vendors to learn about RFPs through a central source. In addition, vendors supported having guidelines for expanded contracting after the pilot phase and new contracting without a RFP process. Relatedly, survey ($n = 14$) and interview ($n = 6$) responses by vendors indicated they most strongly wanted information on needs, decision-making personnel, and the procurement process specific to each district. A final theme in survey responses ($n = 46$) included evaluation assistance, such as rubrics for districts to use when evaluating products, along with guidelines for pilots and trials.

During interviews, district participants were asked to offer vendors advice for working more effectively with district stakeholders. The most common theme was building stronger relationships ($n = 14$). Another theme was providing more specific product information ($n = 8$) and to be honest when sharing information and interacting with districts ($n = 6$).

Relationships and support. District participants expressed in interviews that they are seeking ongoing relationships with vendors beyond the initial sale. A superintendent noted that vendors are, "sales all of the time with the next big thing; [they're] not spending enough time

building relationships." A principal commented that, "providing support before and after the sale is

the most important thing a vendor can do." Relatedly, district participants indicated that a lack of

support after an initial sale would influence whether the district chose to renew a software license.

According to one curriculum director, without a focus on support after an initial sale, the district

"will get out when other platforms become available."

Product information. Especially valued by districts in terms of product information

included evidence of effectiveness, alignment to state standards, references, and information on

how the product aligns to the district needs and goals. As one curriculum director noted, district

administrators lack the time to research the available products and product alignment to district

needs, and "any vendor that saves time by being able to accurately argue fit with the school would

have an advantage." In addition, a superintendent commented on the desire for vendors to, "look at

the state standards and share information with how the product aligns" while a business officer

suggested that vendors need to, "truly understand what it is that the districts are trying to do rather

than saying, 'here's the product. - you'll love it.'" Similarly, a principal commented, "I don't want

to be sold. I want to see the product, understand its features, see the research, do my own,

formulate my questions, and make my decisions. I'd rather get the data and make a decision."

District participants suggested that vendors examine the district website for information in order to

understand their audience, state standards, and the current infrastructure   within the district.

Honesty. According to district participants, vendors need to be upfront as to what is

required for proper implementation of their product. For example, a superintendent commented

that vendors should offer, "more help to think about the conditions to make the product work. If

you know we don't have the conditions, be transparent." A business officer stated, "Please be

candid about what it will really take to implement in terms of time, technology, and infrastructure… be candid about our limitations so we can work with them." Participants also relayed examples of deceptive and dishonest sales practices employed by vendors. Business Officers suggested that vendors review the district procurement practices posted on the website to ensure proper compliance.

Communication. Vendors ($n =5$) agreed with the benefits of more frequent and open communications but countered by noting the difficulty not only of getting an audience with district decision makers but also of receiving communications on the status of the procurement   process. As expressed by one vendor, districts need to, "be more responsive. It takes a lot of time to track people down to move the process along and get some type of direction from them." Another suggested that districts hold a set date to meet with potential vendors and to be receptive to learning about new products.

Discussion

The rapid proliferation of technology in U.S. schools has created both new opportunities and challenges for k-12 educators looking for ways to improve teaching and learning. Our focus in this study was how the growing number of ed-tech products developed for such purposes actually make their way into schools. Although ed-tech procurement can be complex and variable across districts, based on the literature and initial stakeholder focus groups, we framed its processes for this study as comprising five interactive "*Action Points*," starting with *Allotment   of Funding* and concluding with *Acquisition of Products*. Our interest, however, was the three embedded areas that most strongly influence the activities of school district stakeholders and providers: *Assessment of Needs*, *Discovery of Products*, and *Evaluation of Products*. Through

interviews and surveys, we found that processes along the continuum were often uneven or incomplete, and, at best, only partially achieving stakeholders' goals.

Despite the study's contributions, a limitation is its exclusive reliance on stakeholder perceptions and the relatively small sample size for interviews. For extending this research, we recommend comprehensive mixed-method case studies in several school districts to examine more intensively how varied districts acquire ed-tech products and the impacts of different approaches on product usage, end-user satisfaction, and educational outcomes. Interpretations and conclusions of the present findings follow.

Given the uniqueness of ed-tech product procurement processes relative to consumer behavior is more generic contexts (e.g., Gowdy & Mayumi, 2001; Koufaris, 2002; Thaler, 1980), we organized the study and examined its findings through the foregoing "Action Point" sequence and Diffusion of Innovation Theory (Rogers, 2003). Together, these frameworks view procurement activities and decisions as influenced by school district policies, practices, and organizational structures filtered through stakeholder development in accepting and using technology for educational solutions. Extensions of this research might further incorporate consumer theory contextually adapted to the policy confines and multiple stakeholder participation inherent in ed-tech procurement. For example, Thaler (1980) derives from economic research a set commonly employed consumer strategies based on weighing gains and losses for various purchasing options. One strategy that seems particularly apt to ed-tech procurement practices, called "choosing not to choose," is where consumers restrict the costs of having to select between multiple options by restricting the choice set in advance.

Needs as a Starting Point

Although the *Assessment of Needs* is fundamental to instructional design and delivery (Kaufman, Rojas, & Mayer, 1993; Morrison, Ross, Morrison, & Kalman, in press), this initial Action Point emerged as the most weakly practiced of the three examined. Specifically, few district stakeholders conveyed that needs were formally identified or that systematic needs assessments of any type were conducted. Rather, needs were typically identified through routine reviews of student achievement outcomes and shared subjective perceptions of priority areas for improvement. A few participants reported engaging in a reverse, "product-to-needs" process, in which exposure to a particular product through, say, vendor outreach or peer recommendations, created interest in and a rationale for its acquisition. Providers in our study also viewed district needs assessments as valuable by informing them (as providers) what product features and focuses were being sought. Clearly, time and resources are limited for busy administrators and teachers. Failure to include any type of systematic needs assessment, however, increases the risk of disappointment and wasteful spending. Although ideally needs assessments should determine budget allocations by specifying existing gaps and potential solutions, it seems that in the majority of instances, budgets are mostly predefined but subject to modest changes if greater exigency is indicated.

Discovering What's Available

We found the second research focus, *Discovery*, to be the most challenging Action Point for both providers and school districts. Rogers' (2003) Diffusion of Innovation Theory predicts that a district's success in implementing technology depends on stakeholders' advancement through five stages, the first three of which—*knowledge, persuasion*, and *decision*—transpire as potential innovations are sought and identified. Successful completion of these stages promotes *implementation* and *confirmation* as culminating implementation levels.

Early stage progression by school districts in the present study appeared to be inhibited by two extreme, "feast-or-famine," faces of product discovery. On the one hand, district stakeholders were often overwhelmed by the vast variety and quantity of products marketed for popular applications, such as tutorial programs in core subjects. Similarly, the multitude of providers created uncertainties about which to choose to ensure product quality and reliability.

The "famine" side of discovery is reflected in some district participants' reported struggles to find ed-tech products relevant to their needs. RFPs are sometimes helpful but often delay and complicate the acquisition process, while excluding smaller providers who cannot afford the time demands of applying. A possible remedy would be for districts to precede RFPs with Requests for Information (RFIs), which would request more basic information from vendors regarding their products' key properties, evidence support, and cost parameters. From the application information, districts should be able to narrow the potential choices fairly efficiently and invite those selected to participate in a more intensive RFP process or other type of product exhibition.

Marketing materials, conferences, and tradeshows also afford some districts intermittent exposure to a small subset of products. Given the absence of a central, fairly comprehensive source of product information, however, it is not surprising that many districts extensively rely on peer recommendations. Depending on the size of their networks, such information might pertain to only a small number of products. Given the importance of communication channels for the successful diffusion of an innovation (Rogers, 2003), particularly in terms of discovery, it is not surprising that districts rely on trusted sources including peer recommendations. However, Rogers (2003) notes the value of mass media channels in providing awareness knowledge, a venue that is presently lacking in the ed-tech market.

Ed-tech providers likewise experience frustrations with discovery. One challenge is identifying receptive districts and their specific needs regarding product features and cost. Then, the major challenge becomes being seen and heard by district decision makers. Not surprisingly, our findings suggest that smaller companies lacking brand recognition or marketing capacity face the greatest hurdles. Overall, it seems that for discovery to work effectively, providers and districts need more practical and available ways of communicating and connecting.

Evaluating Potential to Work

The fourth Action Point, *Evaluating Products*, has also proven challenging for districts. As conveyed by the present respondents, evaluation is essential to procurement, and most commonly entails pilot studies, references and recommendations from peers, end-user feedback, and rigorous evidence from research reports and publications. Pilot studies, alternatively referred to as beta-tests, rapid-cycle studies, and quick-turnaround studies (Morrison, et al., in press; Davies, 1999; Kelly, Lesh, & Baeck, 2000; Newman, Jaciw, & Lazarev, 2017; Rackham, 1973), offer the advantage of engaging user-practitioners in field-testing an educational product over a restricted period of time (e.g., one semester) to obtain firsthand impressions of its viability. For example, two of the authors conducted "short-cycle evaluations" of 11 ed-tech programs over the course of two semesters in a large school district (Morrison & Ross, 2015). Based on the results, some products were selected by the district as meriting consideration for procurement. Those participants and the respondents in the present study generally viewed pilots favorably as an evaluation strategy. Still, pilots have limitations. One is substantive time demands on the evaluator-teachers. Another is timeliness, as even a one-semester wait for results can be unacceptable when instructional and budget exigencies require immediate actions. A third constraint is that pilots, by design, evaluate products in untested waters navigated by "novice"

teachers and students (Morrison & Ross, 2015). A risk to both providers and district   stakeholders, therefore, is under-estimating product qualities and potential.

How important is research evidence in evaluating ed-tech products? In an earlier survey study, Dagenais et al. (2012) reported that school practitioners rarely used research findings, regardless of whether the research was produced by universities or local schools. Recently,   Penuel et al. (2016) conducted a national survey of how educational leaders use research for   decision-making. Their respondents expressed favorable attitudes toward research in general and   reported a variety of uses, such as for designing professional development and personal growth.   Reliance on using research for selecting programs was lower, a primary deterrent being lag time   between studies and reports. Similarly, our findings suggest that few district stakeholders   actually searched the literature, read journal articles, or consulted review sites such as the What   Works Clearinghouse (also see Penuel et al., 2016), as part of their process. However, when   research evidence became available (e.g., from peers or in vendor portfolios), it was valued and   taken seriously. The obvious advantage of research evidence is its greater credibility than marketing data (Helleman, Burke, May, Charania, & Daniel, 2017), but disadvantages include its   relative inaccessibility, technical nature, and datedness (Dagenais et al., 2012; Newman, Jaciw, & Lazarev, 2017; Penuel et al., 2016).

As with product discovery, district stakeholders reported frequently relying on peer or consultant recommendations for evaluating products. Penuel et al. (2016) likewise found that teachers and educational leaders use peers as a primary source of information about relevant research. As explained to us by several district respondents, although lacking the rigor of scientific evidence, peer impressions represent meaningful real-world experiences of fellow   practitioners, often in contexts very similar to their own.

These considerations overall encourage school districts to employ multiple means for evaluating product effectiveness prior to acquisition. That is, no single source emerges from our study or prior research as sufficient by itself in availability, accuracy, and applicability.

Conclusions and Recommendations

The broad finding from this study is that routine requirements of educational procurement are exacerbated by the plethora of ed-tech products being marketed. Owusu (2016), for example, recently reported that there are as many as 3,900 math and read apps, classroom management systems, and other services, stating that "all those options mean public schools systems have a lot to wade through before they figure out what words for their students and districts" (para. 4).

Providers, in turn, are frustrated by the challenges of making consumers aware of the products and, where there is interest, consummating the sale. These concerns are particularly strong for less-established providers lacking sufficient marketing staff and a record of success. Although no easy solutions emerge, our findings support several recommendations for improving the three Action Point areas examined. For *Assessment of Needs*, where conducting formal, comprehensive analyses are not practical, we encourage districts to perform at least some type of "lean" or pragmatic front-end analysis (Morrison, et al., in press). End-users, such as teachers and principals, should be integrally involved because they are the ones most responsible for implementation and most immediately affected by outcomes. Operationally, "lean needs assessments" could entail a diverse intra-district committee meeting several times to examine school data, canvass opinions from peers and stakeholders, and identify and prioritize needs.

For the *Discovery* and *Evaluation* phases, issuing uncomplicated RFPs (directly framed on the needs assessments) provides a vehicle for learning what products are available from a broader range of providers than would typically apply. The RFP should directly request inclusion

of evaluation support; thus, if rigorous evidence exists, it is bound to be showcased in the proposal. Second, pilot studies serve the multiple purposes of discovering products by inviting   participation by providers who can address specified needs, directly involving end-users in product tryouts, and obtaining firsthand, contextually meaningful evaluation data (Morrison & Ross, 2015; Newman et al., 2017). While a single district obviously is limited in the number of products it can pilot, the potential coverage across many districts could be extensive. This idea   supports a fourth recommendation, which all district subgroups identified in survey responses as   the strongest need to facilitate product discovery and evaluation. Specifically, these stakeholders   and providers supported the development of a national "information exchange" website for disseminating data about products, district experiences in using products, and results from pilot   studies and other research. Relative to rigorous research publications and clearinghouses, this type of information exchange potentially could address the need for timely, consumer-oriented   feedback on product availability and utility, while establishing a practical medium for networking within and between districts and providers. As attention to the ed-tech marketplace   and product effectiveness continues to grow (Newman, Jaciw, & Lazarev, 2017; Cavanagh,   2018), future interest in the website concept remains to be seen. For the present, the evidence in   this paper suggests that the ed-tech procurement process has a way to go to ensure that needed   products become available in schools and classrooms.

This study was highly exploratory given the lack of research regarding ed-tech procurement and has its limitations, predominantly in terms of external validity. Our sample of   district participants and ed-tech vendors may not be wholly representative of the population. A   direction of future research might be to replicate this study with a broader sample of district and   vendor participants. Future research might also include in-depth case studies of school districts

of varying sizes in order to better understand the details and specifics of ed-tech procurement

practices. Future research might also examine a select number of "Action Points' (e.g., conducting

needs assessments, discovering products) in order to provide a more in-depth view of the

associated practices, challenges, and areas of improvement.

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Appendix

Table A1.

Means, Standard Deviations, and Analysis of Variance (ANOVA) Results for Survey Items[1]

		S^a	CD^b	BO^c	TD^d	P^e	V^f	ANOVA F
Indicate your degree of satisfaction with each of the following aspects of procuring ed-tech products (1=very unsatisfied, 5 = very satisfied)								
The district's process for identifying, evaluation, and acquiring needed ed-tech products	Mean	3.93	3.58	3.51	3.78	3.70	2.19[all]	25.926
	(SD)	(0.75)	(0.88)	(1.00)	(0.93)	(0.81)	(0.85)	
The district's competitive procurement processes (RFP or other) for obtaining/processing applications from vendors	Mean	3.83	3.78	3.95	3.69			.835
	(SD)	(0.76)	(0.62)	(0.89)	(0.94)			
The district's non-competitive procurement processes (sole source or other) for obtaining/processing applications from vendors	Mean	3.95		3.80				.756
	(SD)	(0.73)		(0.81)				
Communications between district stakeholders (curriculum director, principals, teachers, technology director, etc) regarding products to address specific instructional needs	Mean	3.81	3.58	3.38	3.22	3.56		2.340
	(SD)	(0.94)	(0.93)	(1.03)	(1.15)	(1.04)		
The involvement by end-users (e.g., principals and teachers) in the selection and acquisition of products	Mean	3.60[f]	3.56	3.55	3.25	3.40	2.96	2.938
	(SD)	(0.89)	(0.96)	(0.88)	(1.04)	1.01	.93	
Vendors' knowledge of state, municipal, and district purchasing policies	Mean	3.48		3.61				.467
	(SD)	(0.80)		(0.97)				
The credibility of product effectiveness evidence submitted by Vendors	Mean	3.31	3.21	3.40	3.03	3.57[d]		4.082
	(SD)	(0.90)	(0.91)	(0.81)	(0.83)	(0.83)		
The time required to complete procurement processes and bring products to end-users	Mean	3.31	2.91	3.10	3.14	3.27	2.23[all]	8.216
	(SD)	(1.05)	(1.02)	(1.09)	(0.98)	(0.91)	(1.03)	
The success of typical purchasing decisions in obtaining the desired ed-tech products that meet specifically identified instructional needs	Mean	3.81	3.70	3.68	3.59	3.60		.600
	(SD)	(0.67)	(0.80)	(0.79)	(0.90)	(0.89)		
State or municipal laws that govern procurement processes	Mean	3.26	3.33	3.46			2.38[all]	12.948
	(SD)	(1.06)	(0.52)	(0.92)			(1.05)	

		S^a	CD^b	BO^c	TD^d	P^e	V^f	ANOVA F
The involvement of the school board in procurement processes	Mean	3.93	3.51	3.73			2.70^{all}	23.713
	(SD)	(0.71)	(0.77)	(0.78)			(0.72)	
The processes for identifying, evaluating, and acquiring needed ed-tech products at the classroom level	Mean					3.61		
	(SD)					(0.97)		
The processes for identifying, evaluating, and acquiring needed ed-tech products at the school level	Mean		3.30		3.46	3.75^b		4.078
	(SD)		(0.88)		(0.99)	(0.89)		
Gaining acceptance or visibility in a district	Mean						2.62	
	(SD)						(1.05)	
Information provided by the district regarding buying cycles and purchasing policies	Mean						2.23	
	(SD)						(0.94)	
Districts' openness to contracting with for-profit Vendors	Mean						3.26	
	(SD)						(0.90)	
Vendor access to district decision makers regarding the procurement process	Mean						2.43	
	(SD)						(0.68)	
Opportunities for conducting pilots in district schools	Mean						3.06	
	(SD)						(1.01)	
Opportunities to expand from pilots to a broader implementation (without a complicated procurement process or RFP)	Mean						2.68	
	(SD)						(1.02)	
Your understanding of districts' instructional needs and preferred pedagogies	Mean						3.21	
	(SD)						(0.98)	
Districts' demands for evidence regarding product effectiveness	Mean						3.09	
	(SD)						(0.83)	

		S[a]	CD[b]	BO[c]	TD[d]	P[e]	V[f]	ANOVA F
Indicate your level of agreement or disagreement with each of the following statements (1= strongly disagree, 5 = strongly agree)								
District procurement processes meet contemporary needs for product acquisitions	Mean	3.57	3.53	3.44	3.37	3.57	1.91[all]	23.408
	(SD)	(0.89)	(0.91)	(1.00)	(1.02)	(0.94)	(0.84)	
De-centralized school procurement processes (significant school autonomy) are desirable for acquiring needed ed-tech products	Mean	2.67	2.53	2.12	2.32	3.51[all]	2.64	15.468
	(SD)	(1.22)	(1.12)	(0.98)	(1.07)	(0.99)	(1.17)	
The district would be likely to use standardized RFPs and contract documents that reflect best practices nationally	Mean	3.74	3.63	4.07	3.61			2.530
	(SD)	(0.94)	(0.79)	(0.61)	(1.08)			
Our procurement processes help me buy the products I already know I want even if from less established Vendors/brands	Mean	3.36	3.35		3.46			.255
	(SD)	(0.85)	(0.95)		(0.82)			
If procurement processes were more efficient (e.g., quicker, less demanding on districts and Vendors), product costs would decrease	Mean	3.31		3.44	3.17		3.74	2.896
	(SD)	(0.90)		(1.07)	(1.05)		(1.05)	
Data privacy and security needs make procurement processes more difficult for ed-tech products than for other products	Mean	3.36			3.19			.748
	(SD)	(0.98)			(0.97)			
I feel secure in my role to pursue the products that appear most effective even if from less established Vendors/brands	Mean					3.39		
	(SD)					(1.09)		
Using standardized RFPs and contract documents that reflect best practices nationally would be desirable in improving procurement processes	Mean						3.30	
	(SD)						(1.14)	
The development of our products is directly informed by research evidence and educational outcomes	Mean						4.43	
	(SD)						(0.80)	
The development of our products is influenced directly by expected requirements for selling them to districts (i.e., typical district procurement processes)	Mean						3.55	
	(SD)						(1.21)	

		S[a]	CD[b]	BO[c]	TD[d]	P[e]	V[f]	ANOVA F
Rate the degree to which each of the following individuals or groups are involved in procurement processes for ed-tech products (1 = not at all, 5 = extensively)								
Degree to which stakeholders are involved: Parents	Mean	1.78	1.73	1.68	1.85	1.90	1.63	.703
	(SD)	(0.85)	(0.81)	(0.88)	(0.87)	(1.03)	(0.91)	
Degree to which stakeholders are involved: Students	Mean	2.54	1.98	2.20	2.54[f]	2.19	1.80	3.135
	(SD)	(1.16)	(1.05)	(1.07)	(1.07)	(1.22)	(1.05)	
Degree to which stakeholders are involved: Teachers	Mean	3.64	3.47	3.48	3.68	3.27	3.20	1.734
	(SD)	(1.06)	(1.14)	(0.93)	(0.99)	(1.26)	(1.05)	
Degree to which stakeholders are involved: Principals	Mean	3.93	3.77	3.88	3.86	3.51	3.70	1.690
	(SD)	(0.78)	(0.97)	(0.79)	(1.04)	(1.15)	(0.94)	
Degree to which stakeholders are involved: Chief Academic Officer (Curriculum Director or similar)	Mean	4.44	4.33	4.20	4.31	4.03	4.47	2.417
	(SD)	(0.63)	(0.84)	(0.91)	(1.00)	(0.92)	(0.72)	
Degree to which stakeholders are involved: Chief Financial Officer	Mean	3.54	3.55	3.28	3.56	3.61	2.70[acef]	4.410
	(SD)	(1.16)	(1.25)	(1.28)	(1.13)	(1.09)	(1.07)	
Degree to which stakeholders are involved: Chief Information Officer	Mean	3.82	3.18	3.84	4.43[bef]	3.33	3.04	9.122
	(SD)	(1.18)	(1.36)	(1.19)	(1.02)	(1.27)	(1.19)	
Degree to which stakeholders are involved: Chief Purchasing Officer	Mean	3.83	3.51	3.92[f]	3.71	3.69	3.10	2.497
	(SD)	(1.27)	(1.29)	(1.18)	(1.19)	(1.04)	(1.28)	
Degree to which stakeholders are involved: Technology Director	Mean	4.85	4.63	4.62	4.81	4.61	3.70[all]	17.113
	(SD)	(0.36)	(0.62)	(0.67)	(0.57)	(0.68)	(1.05)	
Degree to which stakeholders are involved: School Board	Mean	2.79	2.66	2.63	2.73	3.18[f]	2.31	4.247
	(SD)	(0.92)	(1.06)	(1.22)	(1.15)	(1.28)	(0.92)	
Degree to which stakeholders are involved: Yourself (superintendent)	Mean	3.88	4.07	3.68	3.64	3.90	3.41	2.151
	(SD)	(1.02)	(1.00)	(1.25)	(1.17)	(1.03)	(1.22)	
Degree to which stakeholders are involved: 29. Other (please specify and rate)	Mean	3.75	4.00	4.00	3.42	3.17	3.92	.435
	(SD)	(0.96)	(0.00)	(1.00)	(1.44)	(1.33)	(1.32)	

		S[a]	CD[b]	BO[c]	TD[d]	P[e]	V[f]	ANOVA F
To what degree does the district rely on each of the following to identify, select, and acquire quality products? (1 = not at all, 5 = extensively)								
Degree of reliance on: A formal, competitive decision-making process (e.g., RFP)	Mean	3.80	3.70	3.61	3.34	3.50	3.38	1.387
	(SD)	(1.12)	(1.04)	(1.00)	(1.23)	(0.93)	(1.13)	

Degree of reliance on: A noncompetitive procurement process (sole source or other)	Mean	3.22	3.49	3.24	3.25	2.95	3.34	1.939
	(SD)	(0.82)	(1.01)	(1.16)	(1.06)	(1.16)	(1.03)	
Degree of reliance on: A cooperative purchasing process with other districts	Mean	2.90		3.17[f]			2.50	3.600
	(SD)	(1.18)		(1.30)			(1.05)	
Degree of reliance on: Rigorous evaluation evidence (from published studies, literature reviews, etc.)	Mean	3.61	3.45	3.00	3.25	3.48	3.09	2.833
	(SD)	(1.00)	(0.94)	(0.97)	(0.90)	(0.99)	(1.08)	
Degree of reliance on: Non-rigorous evaluation evidence (e.g., from Vendors' in-house studies)	Mean	2.93	2.95	2.63	2.95	2.94	3.68[all]	5.921
	(SD)	(0.96)	(0.82)	(0.97)	(0.92)	(1.05)	(1.02)	
Degree of reliance on: Recommendations from sales representatives	Mean	2.63	2.91	2.68	2.76	2.93	3.02	1.336
	(SD)	(0.92)	(0.92)	(0.91)	(1.02)	(0.83)	(1.01)	
Degree of reliance on: Recommendations from end-users (principals or teachers)	Mean	4.10[de]	3.77	3.68	3.51	3.50	3.94	3.828
	(SD)	(0.67)	(0.97)	(0.82)	(0.82)	(1.01)	(0.87)	
Degree of reliance on: Recommendations from other districts or consultants	Mean	4.00	3.63	3.51	3.78	3.54	4.13[ce]	4.563
	(SD)	(0.71)	(1.07)	(0.81)	(0.74)	(0.90)	(0.82)	
Degree of reliance on: Choosing from a list of "approved" (or recognized) vendors/brands	Mean	3.33	3.26	3.32	3.24	3.39	3.04	.826
	(SD)	(0.89)	(0.98)	(1.01)	(1.07)	(0.94)	(1.12)	
Degree of reliance on: Recommendations or ratings on an informational website (please specify which):	Mean	2.53	2.49	2.18	2.56	2.44	2.11	1.333
	(SD)	(1.18)	(1.16)	(1.09)	(0.93)	(1.09)	(1.15)	
Degree of reliance on: Pilot tryouts of products within the district	Mean	4.20[cf]	3.86	3.37	3.68	3.76	3.32	5.164
	(SD)	(0.75)	(0.99)	(1.04)	(0.92)	(0.93)	(1.00)	
Degree of reliance on: Products with the lowest cost	Mean	3.27		2.76			3.21	3.590
	(SD)	(0.84)		(0.97)			(1.04)	
Degree of reliance on: "Bundled" products (both software and hardware together)	Mean	3.12		3.05	2.61		2.28[ac]	6.903
	(SD)	(1.05)		(1.04)	(0.87)		(1.05)	
Degree of reliance on: Your recommendations	Mean		3.13		3.76[b]			12.204
	(SD)		(0.97)		(.84)			
To what degree might the tool be helpful: Standard evaluation rubrics for judging the quality of products	Mean	3.98	3.98	3.73	3.66	3.77	3.57	1.418
	(SD)	(0.81)	(0.89)	(0.78)	(1.05)	(0.91)	(1.12)	
To what degree might the tool be helpful: Guidelines for conducting effective pilot studies to determine how well a product works	Mean	3.88	3.88	3.73	3.90	4.06	3.91	.889
	(SD)	(0.94)	(0.93)	(0.81)	(0.88)	(0.86)	(0.97)	

		Sa	CDb	BOc	TDd	Pe	Vf	ANOVA F
To what degree might the tool be helpful: Brief case studies or descriptions of "best practices" for ed-tech procurement by school districts	Mean	3.98	3.77	3.63	3.69	3.81	3.96	1.052
	(SD)	(0.95)	(0.97)	(0.80)	(0.88)	(0.98)	(0.72)	
To what degree might the tool be helpful: Guidelines for best practices by individual district stakeholder groups (administration, businesses, end-users, etc.)	Mean	4.14	3.81	3.66	3.66	3.87	3.79	1.953
	(SD)	(0.81)	(0.85)	(0.76)	(0.86)	(0.94)	(0.83)	

		Sa	CDb	BOc	TDd	Pe	Vf	ANOVA F
To what degree might the following tools and guidelines be helpful in identifying, evaluating, and/or acquiring effective ed-tech products? (1 = not at all helpful, 5 = extensively helpful)								
To what degree might the tool be helpful: Guidelines for best practices for Vendors to use in working with school districts	Mean	3.83	3.67	3.78	3.58	3.71		.598
	(SD)	(0.93)	(0.94)	(0.72)	(0.89)	(0.94)		
To what degree might the tool be helpful: A national website for Vendors and school districts, which provides information on procurement practices, product availability, and evidence	Mean	3.79	3.44	3.80	3.54	3.44	3.83	1.857
	(SD)	(0.92)	(0.96)	(0.78)	(0.99)	(1.05)	(1.23)	
To what degree might the tool be helpful: Standard contract language developed by a respected third party	Mean	3.67	3.12	3.73	3.39	3.36	3.67	2.475
	(SD)	(1.03)	(1.00)	(0.87)	(1.02)	(1.21)	(1.03)	
To what degree might the tool be helpful: Guidelines for district expansion after the pilot phase without a new competitive procurement process	Mean						4.23	
	(SD)						(0.84)	
To what degree might the tool be helpful: Guidelines for vendors in building relationships with school districts.	Mean						3.51	
	(SD)						(1.20)	
To what degree might the tool be helpful: Policies for district contracting without a RFP process	Mean						4.00	
	(SD)						(0.96)	

[1] A small number of items were not relevant to the present study focuses, but are listed in the table and identified by an asterisk.

Note: Not all participant groups were asked every survey item. S = Superintendent, CD = Curriculum director, BO = Business officer, TD = Technology director, P = Principal, V = Vendor