

Author Responses to Reviewer Critiques

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Proposal title: Improving the Effectiveness of Digital Educational Tools in Increasing Student Achievement and Reducing Achievement Gaps

Below we present our responses to the major critiques of our original proposal highlighted by the W.T. Grant/external reviewers, and we also address some additional concerns expressed about our project staffing and the observation instrument.

Conceptualization and theorizing

The reviewers asked for a presentation of a logic model or theory of change to aid in communicating the conceptualization of our research and to help focus our analysis plan. We have developed a logic model (see Figure 1) and thoroughly revised both our literature review and the discussion of theories to make clear how our framing of access to and use of technology relates to dimensions of inequality and the pathways through which achievement gaps might be reduced via the enactment and use of the technologies in Milwaukee Public Schools (MPS). For example, in our discussion of the research hypotheses, we now more tightly link them to specific pathways laid out by the logic model and the theoretical framing.

In response to the critique that our literature was somewhat outdated, we conducted another full review of the literature and integrated approximately a dozen more references into the proposal. We also concur with this reviewer's critique that our original proposal did not do enough to link the specifics of our research plan, questions and hypotheses to the academic literature and discussions of inequality and achievement gaps in it. Thus, we extensively revised every section of this proposal to more tightly link our research framing, design and plans for executing the work to how it will address (and contribute to reducing) inequalities in opportunity and resulting achievement gaps.

Study scope

The reviews suggested that the scope of our study was too broad, and that the degree of variation across and within technologies, schools, and implementation efforts would limit the study's contributions. There was particular concern expressed about the specific range of grades in which we would be examining the use of digital tools, the types of digital technology and content area coverage.

Since the time we first proposed this research, we have gathered additional information about digital tool use in MPS and have accordingly narrowed our focus considerably (as described in the revised proposal). We now make clear in the introductory and other proposal sections the two specific tools that we are studying—online (computer-assisted) supplemental instruction and online instruction (course-taking), two of the most widely used tools by school districts—

The investigators add a logic model to clearly map out the theoretical frame of the project and specific steps in the analytical frame. The model shown in Figure 1 takes us from theoretical foundations, inputs, activities, and outputs to the different kinds of outcomes. The model also identifies how the achievement gaps at the heart of the project will be reduced. This is important because the applicant is applying to our portfolio on reducing inequality.

The team alludes to revisions they made in the narrative (not shown) to offer a tightly formulated plan and concrete steps for carrying out the work.

The investigators state and discuss the narrowed focus in the project, e.g., which digital tools will be studied. This bolsters confidence in what can be learned from the study and the feasibility of the approach.

and the specific grades in which they are being implemented and specific targeting criteria for students within those grades (the former, grades 2-3, and the latter, high school students). Of course, there is still variation in MPS in how these digital tools are being implemented and used, and it is this variation that we examine in this study to understand the drivers of use and implementation and how they relate to student outcomes. In the proposal, we continue to use the more “generic” term “digital tools” in much of our discussion of these technologies, simply because it is less wordy (and we note this up front in the introduction).

We are also accordingly now more precise in describing our study samples (see the newly added Table 1) and in discussing our analytic samples and how they will be used in the analysis to address our primary research questions. In addition, we have pared down the primary research questions (as shown in the introduction).

Analysis plan

We agree as well that the critiques of our analysis plan as lacking focus were warranted, and we have accordingly revised this section of the proposal (in conjunction with our revisions to the section that lays out our specific research hypotheses). It was apparent that we were not sufficiently clear about which types of quantitative and qualitative data we would be using to address our specific analysis questions/hypotheses, so we have re-worked these sections to make our analysis plans more explicit. For example, we are now more specific in describing which malleable factors we will examine qualitatively vs. quantitatively (or using mixed methods). We have also tried to be more specific and clear about how we will use and analyze the data from observations and interviews. We have specified a more focused list of malleable factors that we show in our logic model, use in developing our research hypotheses, and reference in the discussion of our analysis plan. In addition, we expanded our discussion of “selection issues” in the analysis plan and emphasize the importance of fully investigating selection in access and use of digital tools, as this information is critical to district and school staff who are interested in understanding and manipulating the factors that determine access and use (and how they might vary by racial and socioeconomic subgroups). We have re-worked our discussion of quantitative methods and models to be more precise about our model specifications and the measures we will be employing. We would also like to note that we have experience in applying all of these methods with data from MPS, including generalized propensity score methods, as can be seen in some of our work recently published in peer-reviewed journals.

Project staffing

One of the reviewers expressed concern about the level of staffing for the observation work, but we think this reviewer mistakenly believed that only a graduate researcher would be performing this work. As indicated in the personnel section of our proposal, the senior staff on this project will also conduct observations and other field research activities, as we think this strengthens all aspects of the research, and particularly the integration of quantitative and qualitative methods. Our expectation of conducting 100 observations per year is entirely consistent with what we have accomplished in the pilot study. In addition, the project PI has additional research resources at Vanderbilt University that she can allocate toward more student research support as needed.

The investigators add a table to clarify their samples. This information will assist staff when re-evaluating the project's rigor.

The investigators correct a reviewer's assumption and clarify who will be doing the work. Further, they provide assurances by linking the proposed number of observations to their prior work. Finally, they provide a strategy in case additional student research resources are needed. Overall, this bolsters confidence in the team's capacity to do the work.

Observation instrument

As discussed in the proposal, we have been using and refining the observation instrument in our pilot study (and previous research) and have conducted trainings and inter-rater reliability tests of its use that we will continue. We are not requesting resources to do a validation study of our instrument. However, in light of one of the reviewer's concerns about the validity and reliability of our instrument, we have added information to Appendix A (where our instrument is presented) to show the theoretical foundations and existing instrumentation consulted in the development of this instrument (that was coupled with our own extensive experience in the field and subsequent testing of the instrument).

The investigators clarify the purpose of the observation instrument and include Appendix A, shown here, to document the underpinnings, both theoretical and empirical, of this instrument.

Figure 1: Logic Model – Improving the Effectiveness of Digital Tools

Theoretical foundations	Inputs	Activities	Outputs	Short-term outcomes	Medium-term outcomes	Long-term goals
<ul style="list-style-type: none"> • Socio-technical theory • International Society for Technology Education’s 14 critical conditions for effectively leveraging digital tools to improve student learning 	<p><u>Structural properties of digital tools</u></p> <ul style="list-style-type: none"> • Online instructional programs • Installed software • Internet or intranet access <p><u>Users of digital tools</u></p> <ul style="list-style-type: none"> • Students prioritized for use • Teachers • Instructional and technical staff support <p><u>Districts</u></p> <ul style="list-style-type: none"> • Financial resources • Technology initiatives • Technology support • Professional development <p><u>Technology vendors</u></p> <ul style="list-style-type: none"> • Digital tool delivery • Training and technical support 	<p><u>Enacted technology structures</u></p> <ul style="list-style-type: none"> • Online, out-of-school tutoring • Online instruction for course-taking, credit recovery • Personalized learning strategies • Blended learning <p><u>Malleable factors</u></p> <ul style="list-style-type: none"> • Vision, planning and management • Training, professional development, capacity building • Technology access, reliability, vendor technical support • Curriculum frameworks and pedagogic approach • Assessment, accountability for closing achievement gaps • Physical settings 	<ul style="list-style-type: none"> • Hours of student tutoring • Logged time on task in online instructional program (and idle time) • Instructional quality • Skill development • Course progression • Time to course completion • Assessment data 	<ul style="list-style-type: none"> • Course completion • Credit accumulation • Quiz grades (in online instruction) • Course grades (in online system and school records) • Standardized test scores 	<ul style="list-style-type: none"> • High school graduation • GED completion • Growth in academic achievement • Achievement gaps by race and socioeconomic status 	<ul style="list-style-type: none"> • Growth in academic achievement • Achievement gaps by race and socioeconomic status • Post-secondary education and training • Certifications and degrees • Labor market outcomes



Table 1: Descriptive Statistics on MPS Students and Study Samples

Student characteristics 2014-15 school year	MPS students	T4U eligible in MPS	T4U participants	Edgenuity participants
Number of students	77,391	2,234	871	2,364
Asian	6%	2%	1%	3%
Black	54%	74%	80%	70%
Hispanic	24%	20%	15%	19%
White	14%	4%	4%	8%
Other race	0%	0%	0%	1%
Female	48%	48%	49%	48%
English language learner	10%	10%	7%	7%
Free lunch eligible	84%	96%	98%	88%
Student with disabilities	20%	18%	14%	20%

Appendix A: Classroom Observation Instrument

Context for Instructional Session

Q1 Date of Observation: _____ Time of Observation: _____

.....(PARTS NOT SHOWN)

Theoretical foundations and existing instrumentation consulted in the development of the observation instrument

Resources consulted in development process

- Digital Bloom's Taxonomy by Andrew Churches
<http://www.techlearning.com/techlearning/archives/2008/04/AndrewChurches.pdf>
- Framework for 21st Century Learning (<http://www.p21.org/overview/skills-framework>)
- iNACOL standards for online courses
(<http://www.inacol.org/resources/publications/national-quality-standards/>)
- Smythe (2012) Toward a Framework for Evaluating Blended Learning (use of rubrics in blended learning environments)
- Laumakis et al (2009) The Sloan-C Pillars and Boundary Objects as a Framework for Evaluating Blended Learning. *Journal Asynchronous Learning Networks* (use of Sloan Consortium including access, blended learning in context of higher ed)
- Salen, Katie & Zimmerman: Eric. Rules of Play - Game Design Fundamentals. MIT Press, Cambridge, 2003. (a definition of "game")

Observation instruments and rubrics consulted in the development process

- SREB standards and checklist for evaluating online courses
(http://publications.sreb.org/2006/06T05_Standards_quality_online_courses.pdf)
(http://publications.sreb.org/2006/06T06_Checklist_for_Evaluating-Online-Courses.pdf)
- Technology Integration Observation Instrument from TPACK
(<http://elvistheteacher.wikispaces.com/file/view/TPACKObservationInstrument.pdf>)
- CLASS observation instrument for student teacher interactions
(<http://www.teachstone.org/about-the-class/>)
- Quality Matters K-12 Online rubric of standards, focuses on online course *design*
(http://www.uwex.edu/disted/conference/Resource_library/proceedings/29483_10.pdf)
- California State University – Chico, Rubric for Online Instruction
(http://www.csuchico.edu/roi/the_rubric.shtml)

General Validity and Reliability in observations

- Hill et al (2012) Validating Arguments for Observational Instruments: Attending to Multiple Sources of Variation. *Educational Assessment*, 17:1–19
- Pianta, R & Hamre, B. (2009). Conceptualization, measurement, and improvement of classroom processes: Standardized observation can leverage capacity. *Educational Researcher*, 38(2), 109-119.