Symposium

Symposium Title:
Stepping Up to Scale Evidence-Based Technology Programs and Practices for Students with Disabilities

Symposium Justification:
Greater rigor in educational research has led to an increase in the number of evidence-based practices that practitioners can implement in their schools. However, despite this growing pool, the gap between research and practice remains large with practitioners struggling to implement and translate practices implemented in researcher-controlled environments to real-world, authentic education settings. To effectively close the education research-to-practice gap, researchers and practitioners need to work collaboratively to balance internal validity, methodological rigor, and fidelity of implementation with external validity, program adaptation and sustainability. Establishing what structures and supports (coaching and professional development) educators need to implement evidence-based practices programs effectively and efficiently assists practitioners with selecting evidence-based practices in their schools with the goal of ultimately improving student outcomes.

The Research to Practice Division in the Office of Special Education Programs (OSEP), U.S. Department of Education, has a history of funding projects that investigate strategies and supports necessary for implementing and sustaining evidence-based practices in real-world settings. It recently introduced the Stepping Up Technology Implementation Program (Stepping Up). Stepping Up projects work directly with teachers and students with disabilities in K-12 classrooms, families, and inclusive early childhood settings. The goals of the projects are to implement a diverse range of evidence-based innovative technology tools and strategies to help educators understand and use the technology in order to engage, motivate, and improve student's classroom outcomes. The projects also systematically investigate the supports and strategies needed for scaling up and sustaining technology practices in multiple sites and the effects of the program on student outcomes.

Presenters will share findings from four Stepping Up projects that used rigorous methods to successfully evaluate, integrate, and scale up implementation of evidence-based curriculum programs in the areas of math, science, and literacy. Two (KinderTEK iPad Math and NumberShire) will present data from randomized controlled evaluations of early elementary technology-based math intervention programs that help students develop proficiency in critical early math concepts and skills from the Common Core State Standards (CCSS) within engaging individualized learning environments. The third will present the results of a randomized controlled trial that tested the effects of an online middle school science program that supports implementation of Next Generation Science Standards to address the learning needs of students with learning disabilities and English learners in public school classrooms. The last presentation will share the methods, findings, and implications of pretest-posttest quasi-experimental design research in secondary school settings to evaluate the effectiveness of EnvisionIT, an innovative online standards-based curriculum designed to teach 21st Century literacy skills, in particular reading, technology, career, and financial literacy, to students with and without disabilities in order to enhance their postsecondary employment and life outcomes.

Dr. Kristen Rhoads, a project officer at OSEP, will engage the audience in a discussion about strategies used to increase the likelihood that the evidence-based practices embedded in each program will be adopted, implemented, and sustained by schools after the project period.

Paper 1:

Conducting rigorous and realistic studies of KinderTEK iPad math implementation

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Context: It is imperative that students exit kindergarten with a solid math foundation so they can engage with later math instruction. Students with low kindergarten math achievement experience persistent difficulty throughout elementary and middle school by a multiplicative factor of almost seventeen (Morgan, et al, 2014). Focused efforts in kindergarten can simultaneously prevent long-term difficulties in math while accelerating the learning of all students. In today's resource-strapped schools, practical solutions for providing all kindergarteners with differentiated instruction within core instruction are critical.

The KinderTEK (KTEK) iPad math program is one such solution. Developed and refined with funding from IES and OSEP, KTEK is uniquely positioned to function both as a standard protocol curriculum with a set scope and sequence and standardized instructional design features, and as an individualized, preventative intervention offering differentiated instruction. The program is aligned with CCSS-Kindergarten Math standards and helps students develop, maintain, and become fluent in critical early math concepts and skills within an engaging learning environment. Students' progress through, and experience with, KTEK is based on their unique response patterns. Reports for educators facilitate understanding of students' strengths and weaknesses and help teachers make data-based decisions.

KTEK development has been guided by evidence from the literature and findings that have emerged during the project. Large, controlled studies conducted near the end of each grant project to examine program efficacy are straightforward to describe and publish. In contrast, the small-scale work that characterizes iterative product development provides (a) rich qualitative data to inform instructional development, and (b) powerful case studies that are important to educators interested in adopting a new practice or program. This tension between research design and practicality is subsumed in the SREE 2018 RFP's questions, "how does the process through which research occurs impact its utility?" and "how should we balance the limitations of the generalizability of research findings with the goal of supporting practical and scalable interventions in complex educational settings?"

Purpose: This paper presents the results of one such study embedded in a larger, iterative implementation trial to examine how (1) short KTEK use (approximately 1.5 months) produced gains compared to business as usual, and (2) the timing of KTEK implementation affected student outcomes. Our second question contrasts two typical uses of KTEK: (a) throughout kindergarten as part of the general education core curriculum, and (b) in the second half of the year as a supplementary intervention. Thus, by comparing effects of early (late fall) and late (winter) implementation, we sought to mimic and evaluate realistic "adoption and implementation of effective research-based practice" (SREE 2018 RFP).

Setting and Participants: The study was conducted in two elementary schools in one Oregon district. All students in six classrooms were invited to participate and all but one did so (129 students, 64 females). A total of 16% of participants were English learners, 12% were identified for Special Education services, and 59% were white, 27% were Hispanic, and 12% were two or more races.

Research Design and Questions: Using a quasi-experimental design, we compared three "early start" classrooms (Treatment) to three "late start" classrooms (Control). Assessments were administered in the fall, before any classrooms used KTEK (T1), just before the winter holidays when the early start students had used KTEK but the late start control group had not (T2), and at the end of the school year when both groups had been exposed to KTEK (T3). Classroom teachers were asked to have all students use KTEK in the default sequenced mode for 15 minute sessions, 3-5 days per week.

We were primarily interested in two research questions. First, did students using KTEK in the fall gain more between T1 and T2 compared to students who had not yet used KTEK? Second, did starting KTEK earlier in the year result in different T1-T3 gains than starting later in the year? Secondary questions related to mediation and moderation regarding student subgroups, dosage, and implementation fidelity were explored and will be presented, but are not reported here.

Data Collection and Analysis: The measurement net for the primary research questions consisted of the *ASPENS* (Sopris; Clarke, et al, 2011) and the *KinderTEK Proximal Assessment (KPA)*, an individually-administered researcher-developed measure. Exploratory analyses also use *KTEK log data* collected to document implementation fidelity, dosage, progress, and mastery and *survey data* regarding teacher and student perceptions of KTEK. The Kruskal-Wallis Rank Sum Test was used to evaluate non-normally distributed measures, and ANCOVAs were used to evaluate normally distributed measures.

Results and Discussion: Results related to our primary research questions suggest KTEK can be successfully implemented in more than one way, but that its effects are greatest when implementation begins earlier in the school year. There were no significant differences between groups at pretest. The early start group had higher T1 to T2 gains for all measures (*Number identification, Magnitude comparison, Missing Number, ASPENS Composite*, and *KPA*), suggesting that KTEK learning transfers to both proximal and distal math measures. The difference between conditions on the *Magnitude Comparison* subtest was statistically significant (Kruskal-Wallis chi-squared = 4.00, $df = 1$, $p < 0.05$). Given that the concept of relative magnitude is a major focus of KTEK's first lessons, this finding is promising because it suggests that KTEK impacts a major skill it was designed to effect and that it provides a strong foundation for later math concepts. We found similar results for our second research question: the early start group had larger T1-T3 gains for all measures, and gains on the *KPA* were significantly greater for the early start group ($F(1,111) = 5.41$, $p < .05$). This suggests that earlier and longer use of KTEK may be the better approach, on average, for classrooms implementing KTEK with all students. Though not surprising, the finding that longer exposure leads to greater effects is important, especially given that students experienced relatively few KTEK sessions between T1 and T2. We will provide a more nuanced discussion of these findings than is possible here and share results of our secondary analyses and experiences developing and evaluating KTEK over the years.

Paper 2:

NumberShire Integrated Tutor System: Supporting Enhanced Implementation of a First Grade, Game-Based Math Intervention for Students with Learning Disabilities

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Background and Rationale

NumberShire is an evidence-based, interactive, gaming and learning platform designed to accelerate the mathematics achievement of early elementary school students with or at risk for MLD. Grounded in strong theory (Donovan & Bransford, 2005) and the converging knowledge base for delivering effective math instruction to students with and at risk for MLD (Cross et al., 2009; Gersten et al., 2009), NumberShire Level 1 (NS1) consists of 12 hours of individualized instructional game play focused on building students' understanding of whole number concepts and skills identified in the Grade 1 Common Core State Standards for Mathematics, including place value concepts, fluency with number combinations, and word problem solving. Game play is organized into 12 themed weeks, each comprised of four 15-minute sessions that utilize explicit instruction to model concepts and skills and deliver frequent guided and independent practice opportunities.

The NumberShire interventions (Level K, Level 1 and Level 2) were developed through three Institute of Education Sciences (IES) Small Business Innovation Research (SBIR) awards, and an IES Goal 2 Development and Innovation grant. Based on evidence for the promise of the NS1 intervention for increasing math learning for students with or at risk for MLD (Fien et al., 2016), IES funded an efficacy trial of NS1 that is currently underway in hundreds of classrooms in Clark County, Nevada. Additionally, stemming from the context described below, the Office of Special Education Programs (OSEP) has funded the authors of this research to develop tools and resources designed to support teachers more effectively integrate evidence-based technology, including NS1, with regular classroom instruction.

The need for game-based math interventions, such as NS1, is based on the fact that students in the U.S. are not acquiring math proficiency at a level required for success in school and the workforce (NCES, 2016) and thus, need more efficacious instruction, and also that education technology has the potential to engage and motivate students to achieve in new ways (Atkins et al., 2010; Thai, Lowenstein, Ching, & Rejeski, 2009). However, there is limited evidence to support the use of technology to support student achievement (Dynarski et al., 2007).

The importance of carefully designing strategies and methods to assist with the implementation of evidence-based technology tools in schools (Perlman & Redding, 2011), especially to benefit students with MLD should not be understated. Given widespread and growing math underachievement, there is an acute need to ensure that these tools are effectively designed and linked to teacher's day-to-day practice to improve early math outcomes for children with or at risk for MLD (Fien, et al., 2011; Nelson et al., 2016). In a recent survey of more than 1000 teachers, providing teachers with access to technology tools wasn't alone enough to guarantee that they would use them effectively (Grunwald Associates, 2010). Taken from the findings of the survey, teachers perceive that education technology has low relevance and utility to support their day-to-day classroom instruction, despite the fact that technology is a necessary area of development for students to adequately prepare them for a range of professions (Langdon, McKittrick, Beede, Khan, & Doms, 2011).

Purpose and Research Questions

The purpose of the current project is to develop and rigorously test the efficacy of the *NumberShire Integrated Tutor System* (NS1-ITS) for improving teacher and student outcomes in first grade classrooms, which includes: (1) the evidence-based NS1 intervention with adaptations to better support learning for students with MLD, (2) a data dashboard to support teachers' data-based decision making, (3) an implementation resource center that uses gameplay and student assessment data to point teachers to tools that have the potential to improve the quality and intensity of classroom instruction for students with MLD, and (4) supplementary student resources designed to meet the needs of students with MLD, including an app to teach self-regulation skills.

The NS1-ITS is intended to (a) improve the learning of students with or at risk for mathematics learning disabilities (MLD) by promoting the use of the NS1 evidence-based technology intervention; and (b) increase teachers' engagement in data-based decision making (DBDM) and ability to provide differentiated, explicit instruction in the classroom to students with or at risk for MLD through the use of tools that supplement the intervention. In the first few years of our OSEP Stepping Up Technology Implementation Project, our specific research questions are focused on the initial development of tools and resources and feasibility of implementation to support increased integration with regular classroom instruction:

1. To what extent do teachers support the relevance and utility of the NS1-ITS for improving instructional practice and math outcomes for students with MLD?
2. Do the configurations of NS1-ITS function as intended?
3. To what extent are teachers able to use data reporting features to track student progress and plan instruction?
4. To what extent are teachers able to use specified differentiated instructional lessons and other features of the implementation resource center?
5. To what extent do teachers and students utilize the adapted features of NS1?
6. Are students satisfied with the NS1 enhancements and self-regulation app activities?

Setting and Participants

In our second year of OSEP funding, we are focused on conducting our Feasibility trial in two elementary schools in two school districts in Lane County, Oregon. Schools that are participating in our research are large (i.e., approximately 618 students per school in K-5), predominantly White/Caucasian, and serve students among whom 66% qualify for free or reduced price lunch.

Intervention

The intervention that will be tested in this research is the full NS1 intervention, including its adaptations (i.e., 12 weeks of NS1 intervention with the option to set session replay, skip, and monitoring features for individual students); data dashboard that reports and summarizes individual gameplay and other student assessment data; self-regulation game-based activities that teach and provide opportunities for students to demonstrate planning, inhibitory control, and attentional flexibility; and the implementation resource center that provides instructional videos and lesson materials to teachers to support the explicitness of core instruction and links between core and intervention instruction.

Research Design, Data Collection, and Analysis

The present study will use a mixed-method design to gather data about intervention components in preparation for single case design and randomized controlled trial pilot and dissemination studies. Trained data collectors will administer student pre- and post-assessments, teacher and student perception surveys, and teacher focus groups that use think-aloud methodology to gather use information designed to improve NS1-ITS assets. All pre-post data analyses will use ANCOVA to assess changes in key variables and control for related covariates.

Results and Conclusions

Results from the feasibility study will be shared in the symposium. We will also share results from the first year of brief implementation trials and the NS1 efficacy trial in Nevada that may have bearing on our development of resources to support implementation of game-based math interventions. In particular, we will describe the importance of conducting an accurate needs assessment and using readiness tools to inform pre-implementation efforts, data behind incorporating more guidance for education professionals to lead them to education tools and resources that meet needs, and a need to simplify the "bells and whistles" featured in education tools with the option for more advanced applications when educators are ready to access and utilize them.

References

Atkins, D. E., Bennett, J., Brown, J. S., Chopra, A., Dede, C., Fishman, B., . . . Williams, B. (2010). *Transforming American education: Learning powered by technology*. Washington, DC: U.S. Department of Education, Office of Educational Technology. Retrieved from http://www.ed.gov/sites/default/files/netp2010.pdf

Cross, C. T., Woods, T. A., & Schweingruber, H. (2009). *Mathematics learning in early childhood: Paths toward excellence and equity*. Washington, DC: National Academies Press.

Donovan, M. S., & Branford, J. D. (2005). *How students learn: History, mathematics, and science in the classroom*. Washington, DC: National Academies Press.

Dynarski, M., Agodini, R., Heaviside, S., Novak, T., Carey, N., Campuzano, L., . . . Sussex, W. (2007). Effectiveness of reading and mathematics software products: Findings from the first student cohort (Report to Congress No. NCEE 2007-4005). Washington, DC: US Department of Education, Institute of Education Sciences.

Fien, H., Doabler, C. T., Nelson, N. J., Kosty, D., Clarke, B., & Baker, S. K. (2016). An examination of the promise of the NumberShire Level 1 gaming intervention for improving student mathematics outcomes. *Journal of Research on Educational Effectiveness*. doi: 0.1080/19345747.2015.1119229.

Gersten, R. M., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools*. (No. NCEE 2009-4060). Princeton, NJ: What Works Clearinghouse. Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED504995

Grunwald Associates LLC. (2010). Educators, technology and 21st century skills: Dispelling five myths. A study on the connection between k–12 technology use and 21st century skills. Bethesda, MD: Grunwald Associates LLC. Retrieved from http://www.grunwald.com/pdfs/Educators_Technology_21stCenturySkills_GRUNWALD-WALDEN_Report.pdf

Langdon, D., McKittrick,G., Beede,D., Khan, B. & Doms, M. (July 2011). STEM: Good Jobs Now and for the Future, U.S. Department of Commerce, Economics and Statistics Administration, Office of the Chief Economist.

National Center for Education Statistics. (2016). *The nation's record card: A first look: 2016 Mathematics and reading*. (No. NCES 2014-451). Washington, DC: National Center for Education Statistics, Institute of Education Sciences.

Nelson, N. J., Fien, H., Doabler, C. T., & Clarke, B. (2016). Considerations for realizing the promise of educational technology. *TEACHING Exceptional Children, 48*(6), 293-300.

Perlman, C. L., & Redding, S. (2011). *Handbook on effective implementation of school improvement grants*. Lincoln, IL: Academic Development Institute.

Thai, A., Lowenstein, D., Ching, D., & Rejeski, D. (2009). Game Changer: Investing in Digital Play to Advance Children's Learning and Health, New York: The Joan Ganz Cooney Center at Sesame Workshop.

Paper 3:

Project ESCOLAR: Research to Practice in Local Educational Agencies through Online Science Units

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Background

Historical and continuing inequities in public education place students who have specific learning needs, such as students with learning disabilities (SWLDs) and English learners (ELs), at risk for academic failure in the U.S. (Noltemeyer, 2012). Despite laws (IDEA, 2004; ADA, 1990) and practices (Kourea et al., 2017) intended to support diverse K-12 students, disparities in academic performance remain across math, science, and reading (NAEP, 2015).

Educational technology has the potential to support diverse students by taking into account their specific needs and using their unique strengths to enhance learning. Traditional teaching methods, such as textbook-based, lecture formats with an emphasis on academic language, are often inadequate for struggling students (Therrien et al., 2011), leading to less college preparation (NCES, 2015) and less representation in STEM careers (U.S. Department of Education, 2015). On the other hand, educational technology has been shown to effectively improve science learning outcomes for middle school SWLDs (Israel et al., 2015) and ELs (Llosa et al., 2016).

The online science curriculum developed and evaluated in the ESCOLAR (Etext Supports for Collaborative Online Learning and Academic Reading) project integrated evidence-based practices. Project-based learning (Boss & Krauss, 2007) was incorporated into virtual and physical labs and projects that students completed together. Culturally relevant instruction (Lee, 2008) gave diverse students the opportunity to draw on their cultures, beliefs, and experiences to support learning—especially for daily warm-up activities.

The online science units also incorporated evidence-based delivery methods. The Cognitive Affective Theory of Learning with Media strategies (Moreno & Mayer, 2007) were embedded to facilitate online navigation and access. Evidence-based eText supports (Anderson-Inman & Horney, 2007) within the units were especially useful for facilitating learning for

SWLDs and ELs, as well as students who had visual and/or auditory disabilities. These supports included: (a) digital note-taking (i.e., click a sentence or question and type notes); (b) text-to-speech (i.e., click a word or passage to hear it read aloud); (c) captioned videos; (d) alt tags (i.e., use a screen reader to hear an image description); (e) an interactive forum (i.e., write questions, answers, or ideas on an online platform and comment on peers' posts); and (f) pop-up glossary (i.e., click an academic or scientific word to see the definition).

Purpose and Research Questions

This paper reports on the ESCOLAR study's implementation of educational technology, in the form of online science units aligned to national standards, to support the learning needs of SWLDs and ELs in public school science classrooms. This research-to-practice project used a randomized controlled trial design to document the effects of the intervention in13 local education agencies (LEAs) over 3 years, following sixth-grade students through eighth grade. The following research questions were addressed:

1. Did the online science units significantly improve science knowledge for middle school students, including SWLDs and ELs?
2. Were teachers satisfied with the online science units?
3. Were students satisfied with the online science units?

Method

Participants

Over the past 3 years, the project followed about 2,000 students from sixth through eighth grade to determine the effects of ESCOLAR's online science units. Table 1 summarizes the number of study participants across 3 years.

Intervention

The ESCOLAR curriculum is a complete set of science units that cover all middle school Next Generation Science Standards (NGSS), including life sciences, physical science, and Earth and space science, and scientific foundational skills (experiments and models).

Each thematic unit provides PBL experiences within an interactive multimedia environment so that students can work collaboratively to solve authentic and culturally relevant problems. Each unit contains five to seven stages, or chapters, of learning that present all the content in 10 to 12 weeks of daily instruction. Stages are organized by lessons, which are divided into PBL activities. Content for each lesson is presented in different formats to: (a) activate students' background knowledge, (b) allow for the construction of knowledge, (c) allow students to practice, hypothesize, and experiment to learn and develop scientific thinking skills, (d) provide corrective and explanatory feedback to students about their knowledge acquisition, and (e) offer dialoguing opportunities and the exchange of ideas through peer-to-peer interactions, small group discussion, and purposeful forum activities. Figure 1 illustrates a sample lesson with eText support enhancements.

Additional resources were developed to support teacher integration of units in their classrooms, including (a) tables showing unit alignment with NGSS and Common Core State Standards, (b) lesson plans and answer keys, (c) student reports, and (d) online professional development modules.

Research Design

The project conducted a 3-year randomized controlled trial that followed a cohort of sixth-grade public school students (Year 1) through eighth grade (Year 3). Treatment group students received the online science curriculum, while control group students learned with their district's or school's standard science curriculum.

Data Collection and Analysis.

Teacher data sources included pre-implementation surveys, professional development evaluation surveys, and post-implementation surveys. Student data sources included pre- and post-implementation science content-specific assessments aligned to the units, post-implementation satisfaction surveys, and background data obtained from the district.

Pre- to post-implementation change in content-specific assessment scores was evaluated with linear mixed models for each year. Power analysis showed that there was sufficient power for the study to detect anticipated small-to-moderate effect sizes.

Results

Figures 1, 2, and 3 present results of content-specific assessments, indicating that treatment group students overall significantly outperformed control students. Trends were similar across subgroups. In addition, teacher and student attitudes about the online intervention were generally favorable, as shown in Table 2.

Conclusions

This project demonstrated that online science units may be used to increase science content knowledge for all students, including SWLDs and ELs, who often are at risk for academic failure (Noltemeyer, 2012). Through its use of evidence-based curriculum and delivery practices for diverse students, the project extends previous research on best practices for these students (Kourea et al., 2017). Middle school science teachers are encouraged to implement the online science units in their classrooms, and thus translate these research findings into practice.

References

Americans with Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 328 (1990).

Anderson-Inman, L., & Horney, M. (2007). Supported etext: Assistive technology through text transformations. *Reading Research Quarterly, 42*(1), 153–160.

Boss, S., & Krauss, J. (2007). *Reinventing project-based learning: Your field guide to real-world projects in the digital age*. Eugene, OR: International Society for Technology in Education.

Individuals with Disabilities Education Act (IDEA), 20 U.S.C. § 1400 (2004).

Israel, M., Wang, S., & Marino, M. T. (2015). A multilevel analysis of diverse learners playing life science video games: Interactions between game content, learning disability status, reading proficiency, and gender. *Journal of Research in Science Teaching, 53*(2), 324-345.

Kourea, L., Gibson, L., & Werunga, R. (2017). Culturally responsive reading instruction for students with learning disabilities. *Intervention in School and Clinic,* 1-10.

Lee, O. (2008). Science education with English language learners: Synthesis and research agenda. *Review of Educational Research, 75*(4), 491–530.

Llosa, L., Lee, O., Jiang, F., Haas, A., O'Connor, C., Van Booven, C. D., & Kieffer, M. J. (2016). Impact of a large-scale science intervention focused on English Language Learners. *American Educational Research Journal, 53*(2), 395-424.

Moreno, R., & Mayer, R. E. (2007). Interactive multimodal learning environments. Special issue on interactive learning environments: Contemporary issues and trends. *Educational Psychology Review, 19*, 309-326.

National Center for Education Statistics (2015). NAEP Data Explorer. *Institute of Education Sciences*. Retrieved from http://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx

Noltemeyer, A. L., Mujic, J., & McLoughlin, C. S. (2012). The history of inequality in education. In A. L. Noltemeyer, & C. S. McLoughlin (Eds.), *Disproportionality in education and special education.* Springfield, IL: Charles C. Thomas Publisher Ltd.

Therrien, W. J., Taylor, J. C., Hosp, J. L., Kaldenberg, E. R., & Gorsh, J. (2011). Science instruction for students with learning disabilities: A meta-analysis. *Learning Disabilities Research & Practice, 26*(4), 188-203.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP). *2015 Mathematics & Reading Assessments Data*.

Table 1

Participants in the 3-Year Randomized Controlled Trial

	Year 1 Sixth Grade	Year 2 Seventh Grade	Year 3 Eighth Grade
Teachers (Total)	(28)	(26)	(17)
Treatment	12	14	10
Control	16	12	7
Schools (Total)	(13)	(13)	(9)
Treatment	7	7	5
Control	6	6	4
Students (Total)	(1,876)	(1,932)	(1,362)
Treatment	1,103	1,049	799
Control	773	883	563
Students with Complete Data	1,451	1,325	1,004
% SWLDs			
Treatment	12%	12%	12%
Control	11%	10%	13%
% English Learners			
Treatment	4%	2%	1%
Control	5%	2%	1%

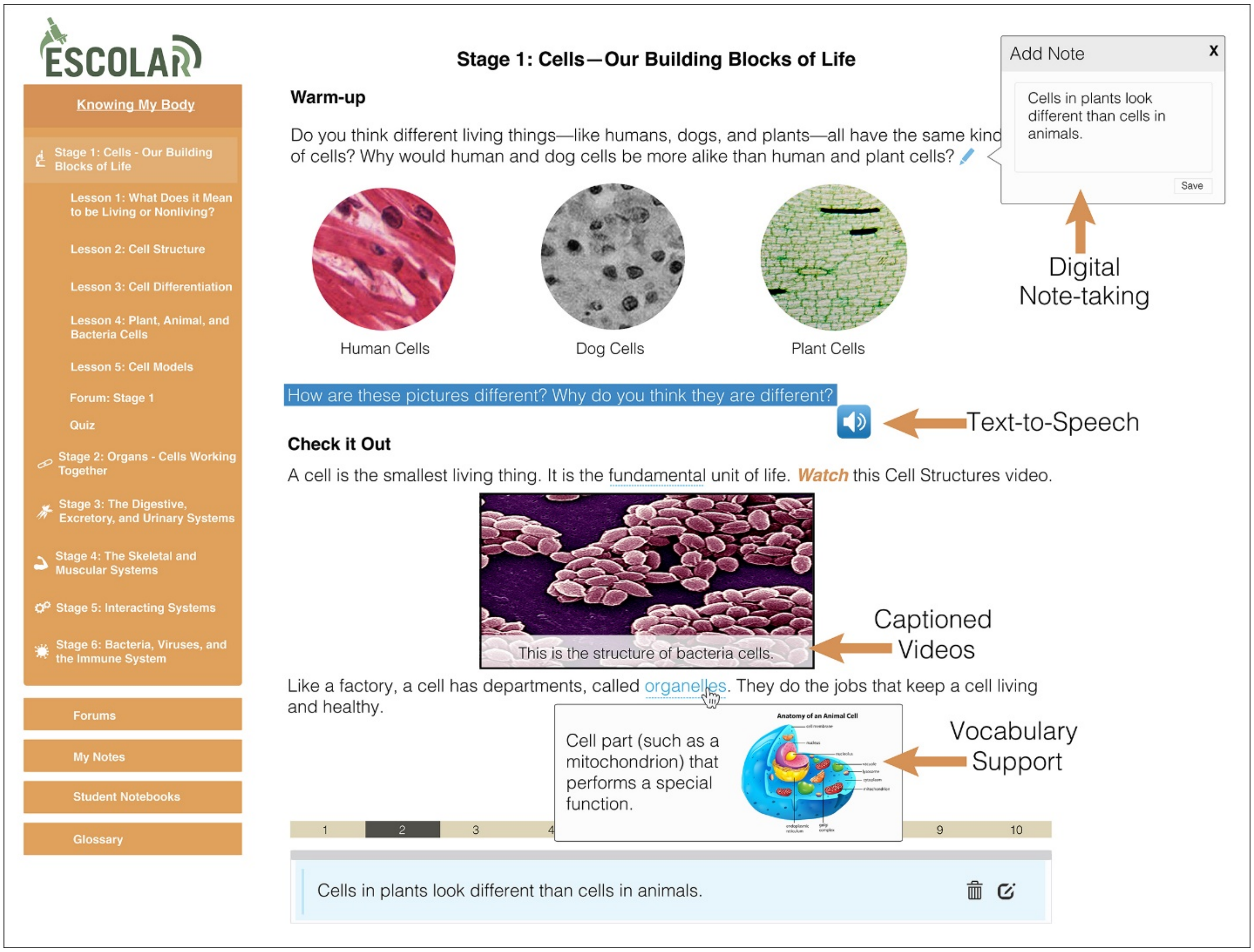
Table 2

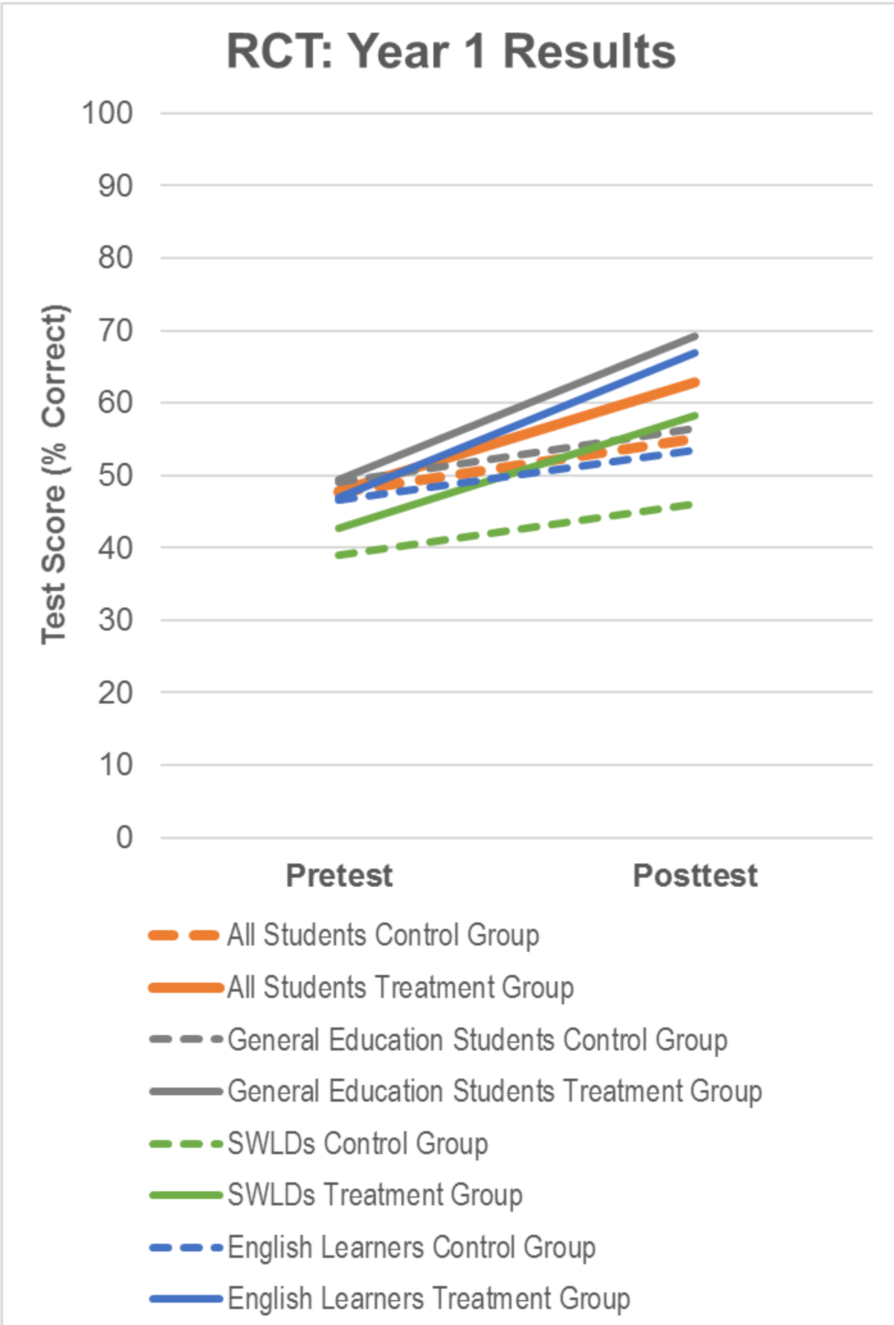
Teacher and Student (Treatment Group Only) Attitudes across 3 Years

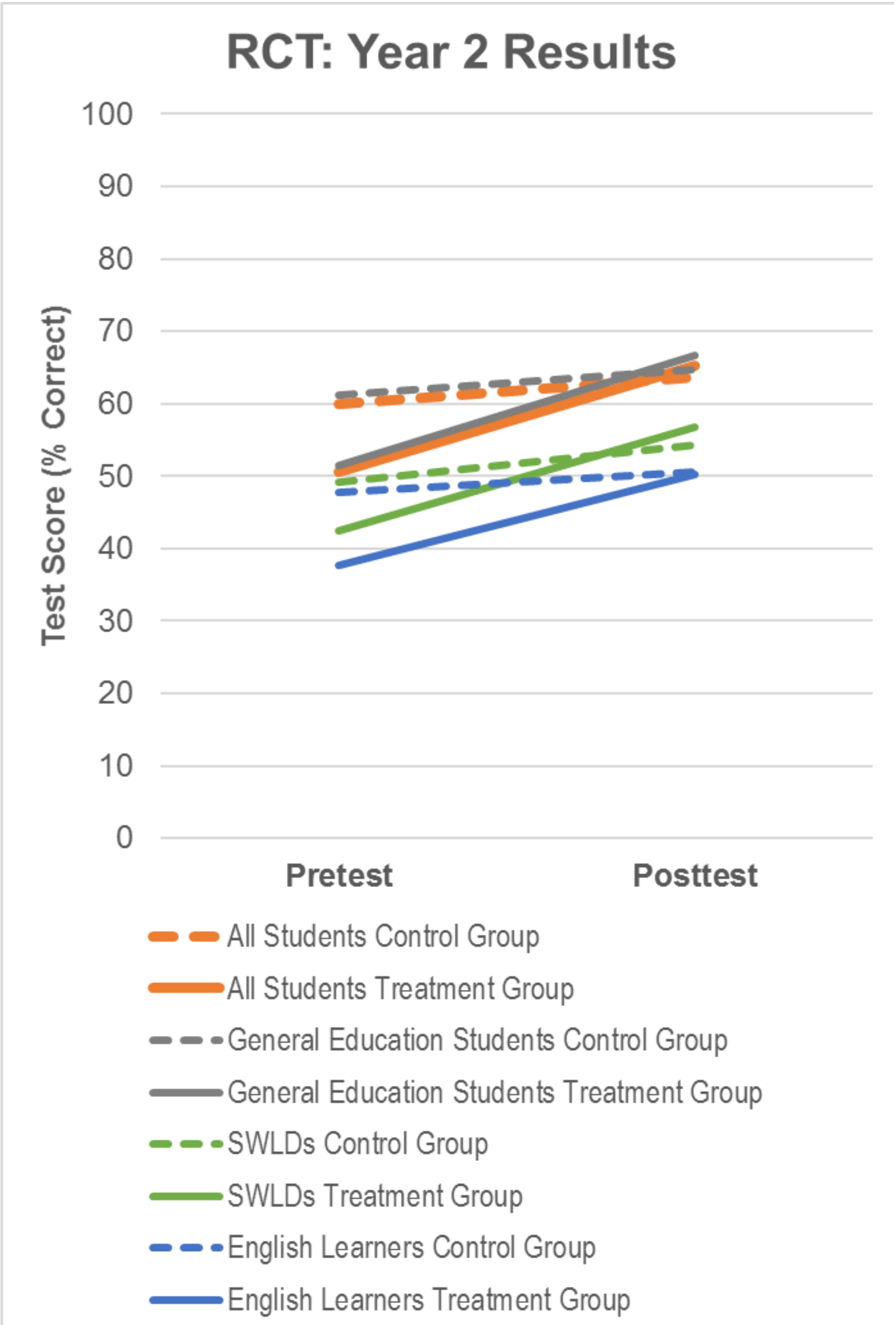
	Year 1	Year 2	Year 3
<u>Teachers (% agree)</u>			
Unit challenging for all students	33%	50%	60%
Unit challenging for students with learning disabilities	38%	62%	100%
Would recommend unit to others	55%	38%	80%
<u>Students (% agree)</u>			
Unit helpful for learning science	29%	72%	51%
Would like to learn from a different unit in the future	23%	76%	78%

Figure Captions

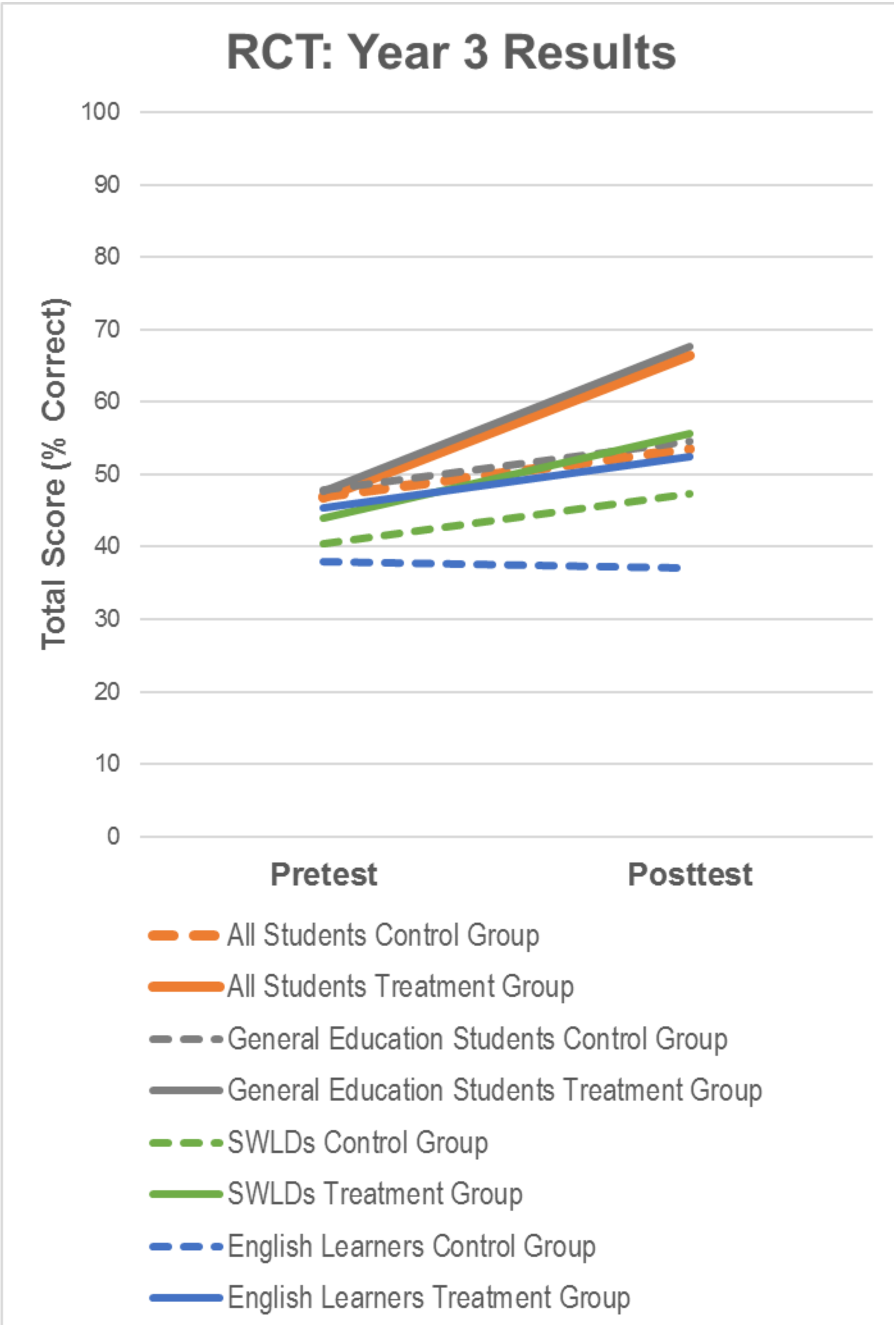
Figure 1. Example of an online science lesson with eText supports.
Figure 2. Pretest and posttest content-specific assessment scores by subgroup in year 1 of the 3-year randomized controlled trial.
Figure 3. Pretest and posttest content-specific assessment scores by subgroup in year 2 of the 3-year randomized controlled trial.
Figure 4. Pretest and posttest content-specific assessment scores by subgroup in year 3 of the 3-year randomized controlled trial.


ESCOLAR
Knowing My Body
Stage 1: Cells - Our Building Blocks of Life
Lesson 1: What Does it Mean to be Living or Nonliving?
Lesson 2: Cell Structure
Lesson 3: Cell Differentiation
Lesson 4: Plant, Animal, and Bacteria Cells
Lesson 5: Cell Models
Forum: Stage 1
Quiz
Stage 2: Organs - Cells Working Together
Stage 3: The Digestive, Excretory, and Urinary Systems
Stage 4: The Skeletal and Muscular Systems
Stage 5: Interacting Systems
Stage 6: Bacteria, Viruses, and the Immune System
Forums
My Notes
Student Notebooks
Glossary
Stage 1: Cells—Our Building Blocks of Life
Warm-up
Do you think different living things—like humans, dogs, and plants—all have the same kind of cells? Why would human and dog cells be more alike than human and plant cells?
Add Note
X
Cells in plants look different than cells in animals.
Save
Digital Note-taking
Human Cells
Dog Cells
Plant Cells
How are these pictures different? Why do you think they are different?
Text-to-Speech
Check it Out
A cell is the smallest living thing. It is the fundamental unit of life. Watch this Cell Structures video.
This is the structure of bacteria cells.
Captioned Videos
Like a factory, a cell has departments, called organelles. They do the jobs that keep a cell living and healthy.
Cell part (such as a mitochondrion) that performs a special function.
Anatomy of an Animal Cell
Vocabulary Support
1
2
3
4
9
10
Cells in plants look different than cells in animals.


RCT: Year 1 Results
Test Score (% Correct)
100
90
80
70
60
50
40
30
20
10
0
Pretest
Posttest
All Students Control Group
All Students Treatment Group
General Education Students Control Group
General Education Students Treatment Group
SWLDs Control Group
SWLDs Treatment Group
English Learners Control Group
English Learners Treatment Group



RCT: Year 2 Results
Test Score (% Correct)
100
90
80
70
60
50
40
30
20
10
0
Pretest
Posttest
All Students Control Group
All Students Treatment Group
General Education Students Control Group
General Education Students Treatment Group
SWLDs Control Group
SWLDs Treatment Group
English Learners Control Group
English Learners Treatment Group


RCT: Year 3 Results
Total Score (% Correct)
100
90
80
70
60
50
40
30
20
10
0
Pretest
Posttest
All Students Control Group
All Students Treatment Group
General Education Students Control Group
General Education Students Treatment Group
SWLDs Control Group
SWLDs Treatment Group
English Learners Control Group
English Learners Treatment Group

Paper 4:

Scaling-Up EnvisionIT: A Model for Teaching 21st Century Literacy Skills to Students with Disabilities

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Background:

Despite the emphasis of higher academic standards and transition services, many students with disabilities (SwD) are leaving school without the academic and 21st Century skills needed to participate fully in employment and postsecondary education. In fact, SwD who are from low-achieving high schools experience higher rates of school dropout, unemployment, and substance abuse, as compared to their non-disabled peers (The National Collaborative on Workforce & Disability for Youth, 2014). When SwD are employed, they tend to earn lower wages (Sanford et al., 2011). They are also less likely to be enrolled in and complete postsecondary education and live independently (Newman et al., 2011). Clearly, these youth are not receiving the essential skills needed to transition to college and careers.

Additionally, the need for information processing and other higher-level cognitive and interpersonal skills is rapidly increasing. These sets of higher-level skills are often referred to as 21st Century literacy or 21st Century skills because workers must have these skills in order to compete and thrive in an increasingly technological world (OECD, 2013). Nearly all students will need to use technology in workplace settings to some extent in their adult life, regardless of their pursuit of employment or postsecondary education after high school (Partnership for 21st Century Learning, 2009). However, even though the number of jobs requiring technology skills is increasing, the number of qualified workers to fill these positions is lacking, thereby creating a deep gap between the demand for, and supply of, skilled labor (BLS, 2015). Workers who lack the 21st Century literacy skills needed to perform increasingly complex and technical work will likely experience poorer employment outcomes (Conceicao, 2016; Levy & Murnane, 2006).

Description of Intervention:

Developed for students with and without disabilities in grades 8-12, the online EnvisionIT curriculum is an innovative standards-based intervention designed to teach key 21st Century literacy and college and career readiness skills that all students need for success in school and in life. EnvisionIT is aligned with numerous national academic content standards in English Language Arts (CCSS), technology (ISTE and NAEP), college and career readiness (NASET), and financial literacy (Jump Start). It is also strategically aligned with fundamental national mandates such as the Every Student Succeeds Act (ESSA) and the Individuals with Disabilities Education Act (IDEA). The curriculum also includes the following evidence-based practices (EBP): 1) Computer assisted instruction; 2) Goal setting, individualized career development, and occupational education; and 3) Reading, test-taking, writing, visual supports, and Universal Design for Learning (UDL) strategies. The culminating product of the curriculum is a comprehensive student Transition Portfolio that includes 14 important items such as age-appropriate transition assessment results, postsecondary goals and plans for two chosen career pathways, a resume template, sample college and job applications, and a digital presentation.

Purpose of Research:

In the current five-year grant (2012-2017), the following four research hypotheses were examined through a quasi-experimental research design: students who take EnvisionIT will score significantly higher in 1) reading achievement, 2) Information Technology (IT) literacy, 3) goal setting/career development, and 4) self-determination. Qualitative research questions explored intervention quality, usability, likelihood of sustainability, and student and teacher satisfaction.

Setting:

The setting included inclusive and special education classrooms across N=10 recruited high schools (5 in Ohio and 5 in Connecticut).

Population:

Students with and without documented disabilities across all disability categories in grades 8-12 who agreed to participate in Year 3 (2014-2015) and Year 4 (2015-2016) of the research design.

Intervention Administration:

General and special education teachers taught the EnvisionIT online curriculum across a semester or school year depending on school schedules and instructional preferences. Though delivered online, EnvisionIT was designed to be a teacher-led curriculum. Lessons learned from prior research in the field have taught us that active teacher guidance, participation, and curriculum pacing are prerequisites for the most successful instructional delivery of EnvisionIT. This type of blended learning approach supports the strategic use of technology in the classroom as an evidence-based practice. For the sake of fidelity, teachers were asked to complete either 70% of the curriculum or all the main activities across units that contributed to the development of student EnvisionIT Transition Portfolios.

Research Design:

The research design utilized was a pretest-posttest quasi-experimental design. Intervention classrooms received EnvisionIT whereas the comparison classrooms did not.

Data Collection, Analyses, and Findings:

The research hypotheses, measures, data analytic tools, and findings based on Years 3 and 4 data are included in the table below with definitions and clarifications in the key and footnotes beneath the table. Validated pretest-posttest measures were used to collect data before and after the intervention. Multiple sample sizes are reported based on the student cohorts being analyzed. In general, findings collectively reveal that, for students who took EnvisionIT in the Years 3 and 4 intervention groups across high schools in Ohio and Connecticut, the curriculum significantly increased student levels of reading, technology literacy, and career/transition as compared with students in the comparison groups who did not take EnvisionIT. No significant findings were reported on the self-determination measure. As of this writing, Year 5 data is being analyzed and therefore findings are not available to report.

While the focus of the quantitative research was on the effect of EnvisionIT on student learning outcomes, many equally important qualitative implementation lessons were learned along the way in regards to intervention scale-up and sustainability in recruited schools and districts. These lessons will be shared with symposium participants as will highlights of key data from project reports and published journal articles.

Table. Scaling-Up EnvisionIT Research Hypotheses, Measures, Tools, and Years 3 and 4 Findings

Research Hypotheses	Pretest-Posttest Measures	Data Analytic Tools	Results: Do They Support Hypotheses	Findings Apply To Which Project Years
1) Students who take EnvisionIT will score significantly higher in reading achievement.	AIMS Web 4^{th} and 8^{th} Grade MAZE reading; TOSREC 9^{th} and 10^{th}-12^{th} Grade	T-test, multiple or hierarchal regression analyses, multivariate statistics	Yes for AIMS Web 4^{th} grade, AIMS Web 8^{th} grade, and TOSREC ---------------- Yes for AIMS Web 8^{th} grade ---------------- Yes for AIMS Web 4^{th} grade and TOSREC ---------------- Yes for AIMS Web 8^{th} grade	3 (N=108)* ---------------- 3-4 (N=355)** ---------------- 4 (N=484)*** 4 (N=371)***** ---------------- 4 (N=484)*** 4 (N=302)****

2) Students who take EnvisionIT will have significantly higher levels of Information Technology (IT) literacy.	ICT LIT CBM	T-test, multiple or hierarchal regression analyses, multivariate statistics	Yes ---------------- Yes ----------------	3 (N=108)* ---------------- 4 (N=484)*** 4 (N=371)***** ----------------
3) Students who take EnvisionIT will score significantly higher in goal setting/career development.	SCCI; VSSE; student satisfaction survey	T-test, multiple or hierarchal regression analyses, multivariate statistics	Yes for SCCI ---------------- Yes for VSSE	4 (N=484)*** 4 (N=371)***** ---------------- 4 (N=484)*** 4 (N=302)****
4) Students who take EnvisionIT will score significantly higher in self-determination.	AIR SDS (Student)	T-test, multiple or hierarchal regression analyses, multivariate statistics	No	N/A

Table Key

AIR SDS = American Institutes for Research Self-Determination Scale
CBM = Curriculum-Based Measure
IT LIT = Information Technology Literacy
SCCI = Student Career Construction Inventory
TOSREC = Test of Silent Reading Efficiency and Comprehension
VSSE = Vocational Skills Self-Efficacy

Project Years

Year 1: 2012-2013 Development
Year 2: 2013-2014 Development/Initial Field Testing
Year 3: 2014-2015 Research Implementation
Year 4: 2015-2016 Research Implementation
Year 5: 2016-2017 Research Implementation and Dissemination

Table Footnotes

**Reflects t-testing and inferential statistics (hierarchical regression analyses) with aggregated sample across all classroom settings (intervention + comparison group) for Year 3 (Autumn 2014 – Spring 2015). N=108. No effects by disability status were found.*
***Reflects inferential statistics (Multilevel Linear Modeling) with aggregated sample across all classroom settings (intervention + comparison group) for all of Year 3 (Autumn 2014 – Spring 2015) and the first half of Year 4 (Autumn 2015). N=355. No effects by disability status were found.*
****Reflects t-testing with aggregated sample across all classroom settings (intervention + comparison group) for Year 4 (Autumn 2015 – Spring 2016). N=484. No effects by disability status were found.*
*****Reflects inferential statistics (Multilevel Linear Modeling) with disaggregated sample across general education setting only (intervention + comparison group) for Year 4 (Autumn 2015 – Spring 2016). N=302. No effects by disability status were found.*
******Reflects inferential statistics (One-Way Repeated Analysis of Variance) with disaggregated sample across all classroom settings (intervention group only) for Year 4 (Autumn 2015 – Spring 2016). N=371. No effects by disability status were found.*
Initial career measures of Career Search Self-Efficacy Scale (CSES) and Goal Setting Scale (GSS) were dropped after Year 3 in order to streamline data collection and were replaced with VSSE. AIR SDS was dropped after Year 3 because of general lack of significance in data on measure in this study and in prior studies. TOSREC was dropped after Year 4 because it did not show as much significance as the other reading measures.

Conclusions:

There is empirical evidence to support EnvisionIT as an effective instructional intervention that increases reading, technology literacy, and college and career readiness. In the current study, we were not able to utilize randomization for a true experimental design. Schools and districts should consider the importance of integrating standards-based transition instruction into their course offerings and programs.

References and Published Research on EnvisionIT:

Bureau of Labor Statistics. (2015). *Employment Projections -2014 -24 [News Release]*. Retrieved from http://www.bls.gov/news.release/pdf/ecopro.pdf

Conceição, S. C. (2016). Competing in the world's global education and technology arenas. *New Directions for Adult and Continuing Education, 149*, 53-61.

Levy, F., & Murnane, R. J. (2006). Why the changing American economy calls for twenty-first century learning: Answers to educators' questions. *New Directions for Youth Development, 110*, 53-62.

The National Collaborative on Workforce & Disability for Youth. (2014). *Guideposts for Success*. Retrieved from: http://www.ncwd-youth.info/sites/default/files/Guideposts-for-Success.pdf

Newman, L., Wagner, M., Knockey, A.M., Marder, C., Nagle, K., Shaver, D., Wei, X., with Cameto, R., Conteras, E., Ferguson, K., Greene, S., and Schwarting, M. (2011). *The post-high school* *outcomes of young adults with disabilities up to 8 years after high school. A Report From National Longitudinal Transition Study-2 (NLTS2)* (NCSER 2011-3005). Menlo Park, CA: SRI International.

Organisation for Economic Co-operation and Development. (2013). *OECD Skills Outlook 2013: First results from the survey of adult skills*. Retrieved from http://skills.oecd.org/OECD_Skills_Outlook_2013.pdf

Partnership for 21st Century Learning. (2009). *P21 framework definitions*. Retrieved from www.p21.org

Sanford, C., Newman., Wagner, M., Cameto, R., Knokey, A.M., & Shaver, D. (2011). *The post-high school outcomes of young adults with disabilities up to 6 years after high school. Key findings from the national longitudinal transition study-2 (NLTS2)* (NCSER 2011-3004). Menlo Park, CA: SRI International. Available at www.nlts2.org/reports/

Published Research on EnvisionIT:

For in-depth discussion of EnvisionIT research methods and findings, please see the following journal articles:

Izzo, M.V., Yurick, A., Nagaraja, H.N., & Novak, J.A. (2010). Effects of a 21st-Century curriculum on students' information technology and transition skills. *Career Development for Exceptional Individuals, 33*(2), 95-105. Available at http://journals.sagepub.com/doi/pdf/10.1177/0885728810369348.

Lombardi, A. R., Izzo, M. V., Rifenbark, G. G., Murray, A., Buck, A., & Johnson, V. (in press). A preliminary psychometric analysis of a measure of information technology literacy skills. *Career Development and Transition for Exceptional Individuals.* Available at http://journals.sagepub.com/doi/full/10.1177/2165143416682476.

Lombardi, A. R., Izzo, M. V., Rifenbark, G. G., Murray, A., Buck, A., Monahan, J., & Gelbar, N. (2017). The impact of an online transition curriculum on secondary student reading: A multilevel examination. *Career Development and Transition for Exceptional Individuals, 40*(1), 15-24, Available at http://journals.sagepub.com/doi/full/10.1177/2165143416681287.

Lombardi, A. R., Izzo, M. V., Gelbar, N., Murray, A., Buck, A., Johnson, V., Hsiao, J., Wei, Y., & Kowitt, J. (2017). Leveraging information technology literacy to enhance college and career readiness for secondary students with disabilities. *Journal of Vocational Rehabilitation, 46*(3), 389-397.