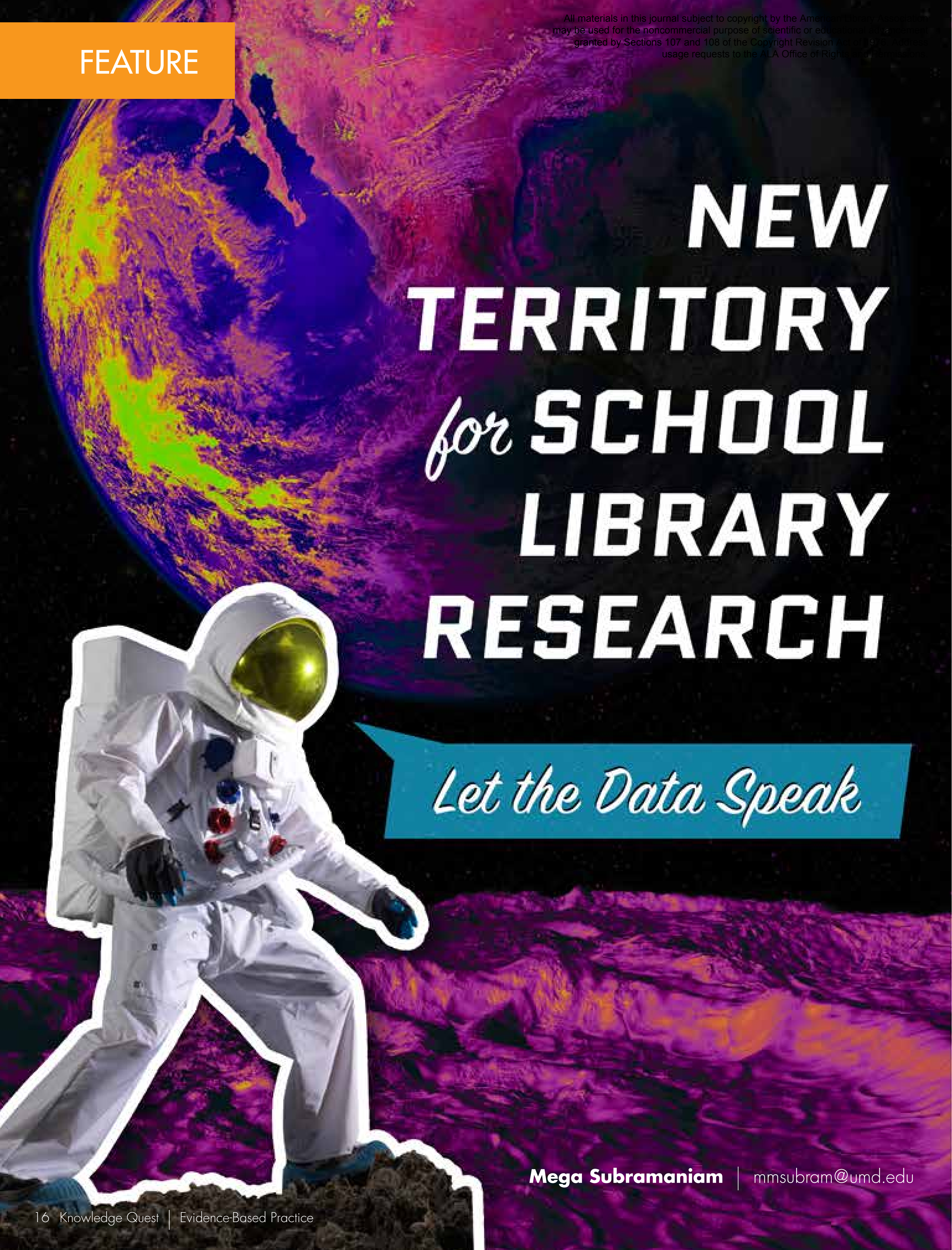

FEATURE

NEW TERRITORY for SCHOOL LIBRARY RESEARCH

Let the Data Speak

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The STEM Challenge

A seminal dialogue on evidence-based practice (EBP) at the International Association of School Librarianship in 2001 encouraged a worldwide paradigm shift in school librarianship from rhetorical and advocacy defenses to evidential documentation. Ross Todd described EBP as evidence *for* practice, evidence *in* practice, and evidence *of* practice (Todd 2006, 2008) "to collectively represent a holistic and integrated framework for professional practice that is robust, reflective and regenerative" (Todd 2006, 36). Since then school librarians have demonstrated their impact on reading and writing. However, evidence of their impact on science, technology, engineering, and mathematics (STEM) achievement is rarely discussed or shared. School librarians spend less time with STEM content because:

(1) They typically have undergraduate degrees in social sciences and language arts, which results in discomfort with STEM content;

(2) They do not believe they have expertise in STEM; and

(3) STEM teachers discount school librarians' expertise to serve as their instructional partners (Subramaniam and Edwards 2014).

This situation must change. The Next Generation Science Standards (NGSS) <www.nextgenscience.org> and the Common Core State Standards for Mathematics (CCSSM) <www.corestandards.org/Math> address scientific and mathematical skills. It is time for school librarians to change their mindset and embrace student achievement in STEM.

School librarians can collaborate with STEM teachers and be instructional partners in mathematical and scientific content areas. With their knowledge and expertise in media and technology, school librarians can encourage students to envision application of STEM practices in their daily lives and inspire them to become scientists and engineers (Subramaniam et al. 2012). It takes a community of researchers, school librarians, educators, and professional organizations to cultivate and sustain EBP in STEM subjects.

New Evidence FOR Practice

In evidence *for* practice school librarians use empirical research to inform practice. A wealth of research, or "big data," substantiates school libraries' impact on students' reading and writing. Unfortunately, we have no empirical or large-scale studies and few statewide studies that demonstrate correlation or causal links between the school library program (SLP) infrastructure, instruction, and services and an increase in STEM achievement. The Partnership for Assessment of Readiness for College and Careers (PARCC) includes a nation-wide assessment for mathematics and recommended state-level assessments for science soon to be administered in some states that have adopted the Common Core State Standards (PARCC 2014 a, 2014b). As a result, school library researchers will have rich data to map the contribution of SLPs to STEM achievement.

The crosswalks between the CCSSM and AASL's *Standards for the 21st-Century Learner* (2014a) and the crosswalk between NGSS and the *Standards for the 21st-Century Learner* <www.ala.org/aasl/ngss> can guide correlational and causal studies. AASL's plan to conduct multi-tier research will contribute big data to strengthen the connections between SLPs and student learning of all subjects (AASL 2014b).

New Evidence IN Practice

Evidence *in* practice links research evidence with school librarians' professional and local experience to identify learning needs and achievement gaps (DiScala and Subramaniam 2011). School librarians need to be familiar with action research frameworks that "direct how evidence is collected, how it is analyzed, and how it is applied to the identified problem" (Gordon 2009, 69). Many how-to articles guide school librarians in assembling evidence *in* practice, but most preparation programs and certifications of pre-service school librarians do not include EBP methods. Nor do professional development and continuing education initiatives on local, district, and national levels target EBP. Fortunately, the most recent *ALA/AASL Standards for Initial Preparation of School Librarians* (AASL 2010) prescribe the inclusion of EBP skills in school librarian preparation so practitioners can process evidence and identify gaps in STEM skills and literacies (and all other subjects).

Evidence OF Practice

Evidence *for* practice and evidence *in* practice prepare school librarians for the focal point of EBP: engagement with local evidence of student work, or evidence *of* practice. In evidence *of* practice, "School librarians measure what students have learned as a result of inputs, interventions, and activities administered in the SLP that the students

Figure 1. Data sources for evidence-based practice.

have participated in" (DiScala and Subramaniam 2011, 63).

Collecting the Evidence

The three dimensions of EBP come together in figure 1 to illustrate "big" and "local" data and their sources. At the center is student achievement. School librarians collect local evidence from survey responses, applied rubrics, and state-based testing data. In STEM subjects, these data can measure the learning of STEM practices as stipulated in the CCSSM and NGSS.

The outer ring of the EBP circle depicts big data generated by school library research to provide evidence *for* practice. Evidence *in* practice sits between local and big data. It resides in knowledge and expertise of school librarians. This is where local and big data become part of the school librarian's work.

Here are a few examples to provide school librarians with ideas on how to collect evidence *of* practice in their SLPs.

Elementary-level PARCC assessments (PARCC 2014c) involve computer-based testing requiring students to transform textual and numerical information into visual representation. Students are expected to master mathematical skills as well as media and visual literacies. School librarians can collaborate with grade-level teachers to assess media and visual literacy and simultaneously collect local data such as:

- Observations of students' interaction with sample exam questions online (before and after facilitation), e.g., dragging and dropping, and creating and manipulating a number line;
- Student self-assessment using a checklist of media and visual skills relevant to PARCC assessments.

Mathematical practices are woven into all grade-level standards in CCSSM. One of the eight mathematical practices in CCSSM is "Use appropriate tools strategically" (Mathematical Practice 5). This practice requires the integration of technology, namely, that students "know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data" (Common Core State Standards Initiative 2014). Similarly, AASL's *Standards for the 21st-Century Learner* (2007) require technology use to analyze, organize, and display information. School librarians and middle school grade-level mathematics teams can collaborate using technology tools such as Infogr.am to visualize probability and statistics, and graphing tools provided by the National Center for Education Statistics <http://nces.ed.gov/nceskids/createagraph> can be used to visualize ratio and proportionality by creating graphs. School librarians can coteach use of these technologies and document improvement of students' skills, as well as monitor formative and summative assessments mapped to Mathematical Practices 5. Local data includes:

- Before and after instruction checklists that enable students to self-assess skills such as changing the types of graphs and creating x, y, and z axes;
- Skills required by formative and summative county assessments,

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skills such as visualizing varying assumptions and comparing predictions with data.

School librarians and science teachers can engage in data-driven collaboration to map skills from the Test of Scientific Literacy Skills (TOSLS) (Gormally, Brickman, and Lutz 2012) or from local high school science or biology assessments to skills and dispositions in AASL's *Standards for the 21st-Century Learner* and administer these tests on a systematic or diagnostic basis. Systematic administration of these assessments captures the contribution of SLPs over time and informs school librarians' day-to-day teaching decisions. Sections of the tests can be administered diagnostically when specific instructional problems arise. For example, the TOSLS test includes items that require students to evaluate reliability of a science website. This task clearly links to skills 1.1.4 and 1.1.5. in *Standards for the 21st-Century Learner* (AASL 2007). In this example, local data include TOSLS scores (full or selected sections in the assessment).

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Moving Forward

School librarians have demonstrated their impact on student achievement in reading and writing. It is time for them to explore new territory to discover how to facilitate the learning of technology and textual, visual, new media, and information skills targeted by NGSS, CCSSM, and STEM state standards. Collecting and analyzing local data reveals SLPs' contributions to essential STEM literacies. Let's capture data that tells the story of school librarians' contributions to STEM education so school librarians can stake their claim as essential collaborators in ALL content areas.

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