Power in Numbers: Advancing Math for Adult Learners

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The United States Department of Education project, Power in Numbers: Advancing Math for Adult Learners aims to help adult learners receive the higher-level math skills they need to succeed in the real world. The initiative has published two of three planned reports, and a review of selected Open Educational Resources (OER) by an initial cohort of adult classroom teachers. In this paper, the authors delve into the project focus — how OER can help serve the unique needs and learning styles of adult learners — as well as describe the goals for the upcoming final year of the project and share progress to date. Both share their experiences as part of the project team and their aspirations for the products that will exist by the conclusion of the initiative.

In 2016 The United States Department of Education Office of Career, Technical, and Adult Education launched a three-year initiative project, *Power in Numbers: Advancing Math for Adult Learners,* that seeks to bring high-quality open technology solutions to adult education. The project recognizes the problem that applied mathematics skills are a gatekeeper for further education and training and significantly affect employability and career options. They see the need for the nation to improve access to high-quality education and training experiences for students at all levels, and for workers at all career stages. One resource that has proven useful in the Kindergarten-12th grade arena is Open Educational Resources (OER) and the department saw that these have the potential to elevate higher-level math skills for adults.

Open Educational Resources

OERs are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others (https://wiki.creativecommons.org/wiki/What_is_OER%3F). OERs can take many forms, such as syllabi, lesson plans, tests, experiments, simulations, course designs, videos, software, teaching techniques, group activities, writing prompts, textbooks, and learning modules. There are no platform restraints. However, OERs must:
- Exist either in the public domain, or under an open intellectual property license
- Have the ability to be revised, remixed, added upon, translated, and then shared again to meet different needs (Illinois University Library, 2018).

OERs can help educators by reducing costs, increasing efficiency, improving instruction, encouraging contextualization, and expanding access and equity. Some of the OER resources identified during the course of the *Power in Numbers* project are:

- **OER Commons** (*recommended*)
  www.oercommons.org
- **Merlot**
  www.merlot.org/merlot/index.htm
- **Creative Commons Search**
  http://search.creativecommons.org
- **SkillsCommons** (*Workplace/Vocational*)
  https://www.skillscommons.org/
- **National Science Digital Library**
  https://nsdl.org/

The *Power in Numbers* Project

The *Power in Numbers* project has four major goals:

- Elevate the quality of advanced mathematics teaching and learning through next-generation technologies and open educational resources (OERs).
- Identify effective technologies and resources for adult educators and empower educators to use them.
- Build and support a community of adult educators creating and using open content and innovative technologies.
- Expand and scale to impact adult learners across the nation.

Two major initiatives support this goal. The first is a series of three research reports which explore education technology in the adult education classroom. Luminary Labs released the second of the three in April, 2018 and anticipates the publication of the third by the end of 2018. The second initiative utilizes teacher user groups who focus on tackling hurdles that prevent OER from entering adult education. These initiatives are working together to expand the accessibility of adult education technology used to support adult learners in the math classroom.

Market Scans

The Department of Education goal for the research reports or *market scans* is to guide funding, implementation, and classroom integration decision-making by stakeholders including funders, education providers, and teachers. The first market scan, entitled *The Math Gap: Implications for Investing in America's Workforce* makes the case for the use of OER in the adult education classroom. It delves into the adult education landscape, analyzing the key stakeholders — employers, learners, and educators — and explores how technology solutions can meet their unique needs, with a focus on OER Luminary Labs, 2017). Three major findings presented in that report are:

- **Technical capabilities, equity, and access remain a hurdle.** Across technology areas, digital literacy and equity continue to be barriers to access for some of the most under-skilled adults.

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  Contextualization is key. Adult resources need to be grounded in real-world applications and deliver skills that translate to employment.

- **Industry needs a voice.** Employers need to play a larger role in the shaping of both content and classroom resources.

The second market scan, *Multiplying Impact: Five Frameworks for Investment in EdTech for Adult Learners* explores the current adult edtech market, assessing the existing landscape of solutions, and provides a framework for analyzing impactful technology investments in adult education. This report proposes that edtech investors and developers focus on five key areas in which technology can greatly enhance adult education outcomes:

- **Supplement the instructor.** Technology tools need to optimize instructors' scarce time and resources.
- **Design for life.** Technology needs to allow for learners' lives and reduce friction in attendance.
- **Engage the learner.** Technology must capture learners' attention and then retain it.
- **Build the community.** Technology can foster community and collaboration for better learning outcomes.
- **Connect the dots.** Teaching and learning resources need to connect content to learners' personal contexts, in life and at work.

The report stresses the fact that *Power in Numbers* examined opportunity areas for technology to drive impact for adult learners. It proposes that edtech investors and developers focus on the five key opportunity areas, and invest in technology solutions to improve adult education outcomes. Each opportunity area explored represents a framework for analyzing technologies to achieve maximum impact. With the right attention and funding, investment in the development of digital tools and technology solutions can not only tap into an underserved market, but also radically transform the experiences of adult learners and educators in math and beyond (Luminary Labs, 2018a).

The third market scan, *From Creation to Adoption: How to Develop and Deploy Successful EdTech*, set for publication in fall of 2018, discusses the current market dynamics of adult edtech, analyzing problem areas, and identifying opportunities to better facilitate the production and integration of high-quality edtech in the adult classroom (Luminary Labs, 2018b).

Subject Matter Experts
Subject Matter Experts (SME) provided guidance on *Power in Numbers'* initiatives to improve adult educators' understanding and use of high-quality OER and educational technologies for mathematics instruction. They represented a cross-section of adult and mathematics education and the OER technologies available to serve that population. The Subject Matter Experts were:

- **Jo Boaler** is a Professor of Mathematics Education at Stanford University, and the co-founder of youcubed. She is also the author of the first MOOC on mathematics teaching and learning.

- **John Comings** is a Senior Technical Consultant at World Education, an international NGO based in Boston and an adjunct faculty member at the Center for International Education at the University of Massachusetts at Amherst.
- **Iddo Gal** has been active for many years in the area of adult numeracy, and is a Special Senior Advisor for Literacy/Numeracy Assessment at the International Literacy Institute. He chaired the expert group that developed the conceptual framework and assessment scheme for OECD's Survey of Adult Skills (PIAAC), after working on the Adult Literacy and LifeSkills survey, is a member of the OECD expert group on skills use and skills mismatch, and Past-President of the International Association for Statistical Education.
- **Amee Evans Godwin** is the Director of Innovation and founding Program Director of [ISKME's](#) digital public library, [OER Commons](#).
- **Gerard L. Hanley** is the Assistant Vice Chancellor for Academic Technology Services and the Executive Director of [MERLOT](#) (Multimedia Educational Resource for Learning and Online Teaching) for the California State University, Office of the Chancellor.
- **Chonda Long** is the Director of Professional Development at the National Council of Teachers of Mathematics.
- **Dan Meyer** is the Chief Academic Officer at Desmos where he explores the future of math, technology, and learning.
- **Katherine Safford-Ramus** is a Professor of Mathematics at Saint Peter's University. She holds a doctorate in Mathematics Education with a focus on adult learning from Rutgers, the State University of New Jersey. She has been teaching mathematics at the tertiary level for more than 30 years.
- **Patti Smith** is the Chief Marketing Officer & Co-Founder of Querium, a platform she co-founded to develop artificial intelligence-based technology to help teens and adults succeed in mathematics through step-by-step virtual tutoring assistance.

The SMEs met at three summit meetings: two virtual and one in-person at the headquarters of the United States Education Department (USED) in Washington, DC. At the first virtual summit meeting in January, 2017 the SMEs discussed nuances of the adult teaching and learning environment, and OER and classroom technology usage in the adult education classroom. This meeting and ensuing individual conference calls informed the first market scan.

At the second meeting in Washington, SMEs convened to survey the landscape of edtech tools, key stakeholders in the edtech market, current inefficiencies, and barriers to edtech production and adoption. During the follow-up virtual summit in January, 2018, SMEs discussed the opportunity areas for edtech tools to impact adult math education. These two summits helped to inform the Luminary Labs authors of the second market scan, *Multiplying Impact: Five Frameworks for Investment in EdTech for Adult Learners.*

Key messages that emerged from the summits thus far include:
- **The discovery process is network-based.** SMEs agreed that relatable testimonials from teachers are key to gaining buy-in from teachers and administrators. This has wide-ranging implications: on a product level it highlights the importance of meta-data and reviews and, on a procurement level, it underscores the need for teachers' voices to be heard by edtech creators and administrators.

- **Professional development is crucial.** Educating and empowering instructors to make the most of available resources is as crucial as the identification of resources themselves. A powerful way to achieve this is to rely on teacher communities that already exist.
- **Communities of practice.** Within adult education, communities of practice will play an integral role in the successful implementation of OER into adult education classrooms.

User Groups

Concurrent with the work on the market scans, two groups of users, classroom teachers, strove to review OERs and incorporate them into their courses. Their goals were to identify and evaluate high-quality OERs to enhance the teaching and learning of advanced math among adults, build a database of trusted and detailed reviews to help educators more easily find the best OERs, create teacher-facing resources to facilitate OER usage, and create community of OER users to share learning and best practices.

There were two cohorts of users. The first was tasked with addressing the lack of curation that limits the searchability of adult-appropriate OER. It consisted of a community of 18 adult educators from 13 different states and a variety of education institutions including correctional facilities, local education agencies and community colleges. Beginning in the fall of 2017, User Group 1 rated, reviewed, and categorized more than 70 OER for adult math. These standards-aligned, free, and accessible resources are now available and searchable for all adult educators through OER Commons, a public digital library of OER (www.oercommons.org).

User Group 2 was charged with addressing the lack of support for OER integration into adult math classrooms. It was community of 20 adult educators from 19 different states and a variety of education institutions including community centers, correctional facilities, and charter or adult schools. Brooke Istas was a member of both user groups. In the spring of 2018, User Group 2 created and reviewed 20 original OER curriculum guides. These resources, made by educators for educators, open the door for more educators to experiment with and benefit from OER.

Based on their experiences in the *Power in Numbers* project, the user groups recommended to USED that:

- **OER has a bright future in adult education.** User group data confirmed educators' view of OER as a valuable resource. Feedback from User Group 1 specifically showed an overwhelmingly positive approval of OER in their teaching.
- **Communities and circles of support are key.** Interaction with fellow educators elevated experiences. LINCS[1] Community of Practice and Virtual Teacher Summit served as resources for knowledge sharing, professional support, and access to educators who may act as a resource in the inner or middle circle.

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[1] LINCS is the acronym for Literacy Information and Communication System which was designed to organize and promote resources within the field of adult education and serve as a central repository for information. It is managed by the U.S. Department of Education's Office of Career, Technical, and Adult Education.

- **Identification without integration misses the mark.** OER are only as powerful as their ability to be integrated into teaching programs. 33% of user group participants cited difficulties with integration as a major issue while testing OER in their classrooms
- **Professional development and OER go hand in hand.** Continuous professional development opportunities are needed to support OER usage. The demand for User Groups 1 and 2 and positive feedback on SME Spotlight sessions highlighted the benefit and desire for professional development opportunities, such as *Power in Numbers*, for adult educators.

Presenter *Power in Numbers* Experiences

Kathy's Reflection

Prior to working on this project I had limited exposure to OERs. At the 13TH International Congress on Mathematical Education (ICME-13), Pradeep Misra presented a paper that discussed the potential for OER in adult education internationally (Misra, 2018). His work spiked my interest in these resources and the chance to participate in the *Power in Numbers* project that fall came at an opportune time for me. Up until that time I had dabbled in the incorporation of Internet resources in my seminar courses, usually *YouTube* videos, and the student response to them was favorable. The invitation to serve on the SME panel offered the opportunity to learn more about OERs while at the same time allowing me to share my knowledge of adult mathematics education with individuals less-experienced in that special research niche.

Participating in the three summits, particularly the Washington summit, was an energizing experience. Each of the attendees contributed their "piece of the puzzle", allowing a clear picture of the potential for OERs to enhance adult mathematics education to emerge. Perhaps the most valuable information I took away from the meetings concerned the existence of curated archives of OERs suitable for adult students. Regrettably, these are not well known and I hope this project succeeds in bringing them to the attention of the wide audience that can benefit from their availability from adult basic educators to university mathematicians.

During the month of March, 2018, I served as the resident SME for the LINCS user group community. The discussion was bi-directionally informative. Each week I posed questions that focused on a specific aspect of adult learning theory to the users. They, in turn, provided responses "from the trenches" as well as questions for me to ponder concerning their particular instructional venue. I found the experience instructive and rewarding and believe there is potential for ALM to use similar discussion groups for subgroups within adult mathematics education as well as the conduct of courses in the field.

Brooke's Reflection

The *Power in Numbers* project part one focused on reviewing the OER mathematical resources that are available to the field of adult education. Each one of the participants was to identify five or more; then this list was pared down to three. OER were rated based on the quality of explanation of the subject matter, the utility of materials designed to support teaching, quality of assessments, quality of technology interactivity, quality of instructional and practice exercises, and opportunities for deeper learning, each on a three-point scale. Having practitioners complete these reviews helped them

to interface with the website and began to see the value of this resource. Additionally, by allowing the practitioners to rate the OER adds a quality element that is often missing in adult education lessons.

In part two, practitioners were to create original OER lessons along with having an accountability partner to brainstorm ideas with and flesh out any questions that may have arose as lessons created. After the original lesson was uploaded to OER Commons, it was rated by other practitioners so that the quality could be measured and any issues could be fleshed out and fixed. By having practitioners create lessons and upload to the site, they began to realize how easy the process was and several said they would continue to introduce lessons on the site.

In part one and two, practitioners were invited to participate virtually through discussion boards and virtual conferences with leading experts in the field of mathematics education. For many practitioners, engaging with these experts was the equivalent to meeting a movie star. Their knowledge and openness to share with both groups of practitioners made the *Power in Numbers* project stronger because it brought adult education to the forefront. Several of the questions asked to the experts were outside their scope of research, but they were vested in learning from the practitioners as much as the practitioners were vested in learning from them. It was a mutual partnership of adults trying to help adult learners in the field of mathematics.

Overall, the *Power in Numbers* project was a great start to address a national need in the field of adult education. It provided a bridge between experts in the field of mathematics instruction with practitioners in the field of adult education. Plus, it gave the field a place to share resources to a broader audience with a rating that practitioners can understand.

Conclusions

The *Power in Numbers* project is in its third and final year. The market scans produced have international applicability and present arguments for the creation and utility of OERs that cross global borders. It is imperative, however, that the work be widely disseminated so that the existence of the reports is known. The market scans make a strong case for the funding and creation of OER resources by commercial and individual producers.

Even more critical for the ALM audience is the availability of the work in the curated libraries. There is a wealth of texts, lesson plans, and videos, etc. waiting for instructors and students to use to their advantage. Whether incorporated into a traditional or online course or used by an enterprising adult student for self-improvement, OERs are a welcome addition to the landscape of adult mathematics education. Brooke has already contributed to the OER depository and Kathy plans to do so in the coming year. OERs are another device in the toolbox that adult mathematics educators bring to their task. We encourage the reader to visit the sites presented and shop for items that may be of use to them in their instructional enterprises.

References

Illinois University Library (2018). *Open Educational Resources (OER): What Are OER?* Retrieved from http://guides.library.illinois.edu/oer

Luminary Labs. (2017). *The Math Gap: Implications for Investing in America's Workforce.* https://lincs.ed.gov/publications/pdf/Advancing_Math_Market_Scan_1.pdf

Luminary Labs. (2018a). *Multiplying Impact: Five Frameworks for Investment in EdTech for Adult Learners.* https://lincs.ed.gov/publications/pdf/advancing_math_market_scan_2_4-13-2018.pdf

Luminary Labs. (2018b). *From Creation to Adoption: How to Develop and Deploy Successful EdTech.* (link not available at press time)

Misra, P. K. (2018). Lifelong mathematics learning for adult learners and open educational resources. In Safford-Ramus, K., Maaβ, J., and Süss-Stepancik, E. (Eds.), *Contemporary Research in Adult and Lifelong Learning of Mathematics: International Perspectives* (pp. 269-283). Cham, Switzerland: Springer.