Volume 3, Number 2, Summer 2014

Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education

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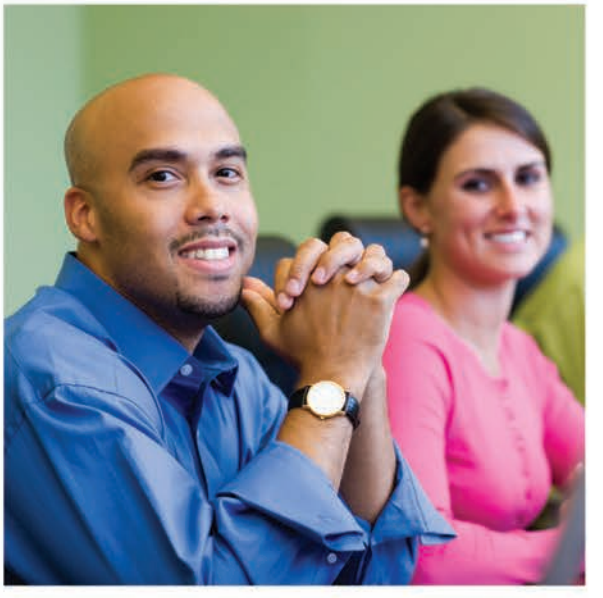

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JOURNAL OF RESEARCH AND PRACTICE FOR ADULT LITERACY, SECONDARY, AND BASIC EDUCATION

Published Jointly by The Commission on Adult Basic Education and Western Kentucky University

The COABE Journal, Celebrating 36 Years as a Major Voice in Adult Education

Dear Readers,

We are pleased to release our second issue in the third volume of the Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education. In this issue you will find three research articles focused on the effects of psychological disorders on general education development students, barriers to the teaching and development of higher mathematics curriculum to adult basic learners, and the predictability of spelling ability for low-literate adults. Each of these articles provides a unique insight into the learning and literacy needs of adults as they work to address various basic skills.

In "General Education Development (GED®) Credential Attainment, Externalizing Disorders, and Substance Use Disorders in Disconnected Emerging Adults," Bergman, Kong, and Pope examined whether the presence of externalizing disorders, such as attention-deficit disorders, substance abuse disorders, and antisocial personality disorders, predicted GED® attainment in 109 emerging adults. The researchers used the Modified ADHD Interview for Adolescents, Parents' Rating Scale, the Structured Clinical Interview for DSM-IV: Non-patient Version, Structured Clinical Interview for the DSM-IV Axis II Personality Disorders, Kaufman Brief Intelligence Test, and GED® Completion. They found that verbal ability, i.e. KBIT Vocabulary score, correlated with GED® attainment.

In "Teaching a High-Level Contextualized Mathematics Curriculum to Adult Basic Learners," Showalter, Wollett, and Reynolds conducted a qualitative study on the process of implementing a pilot curriculum in mathematics across the state of Ohio. Twelve math instructors were examined and asked about the barriers to implementing the curriculum and adaptations employed throughout the process. Barriers were identified, but instructors adapted to these barriers by modifying the materials and supports used in the classroom. As a result of the adaptations and instructor ingenuity, students were able to master the math and make connections with life experiences.

In "Investigating Predictors of Spelling Ability for Adults with Low Literacy Skills," Talwar, Cote, and Binder examined the predictability of spelling abilities based on phonological, orthographic, and morphological awareness. Using a variety of spelling tests and measures, the researchers examined 60 adult basic education students on several spelling abilities by executing phonological, orthographic, and morphological tasks. Using regression analysis, the researchers found that phonological and orthographic knowledge predicted spelling scores whereas morphological awareness did not.

I encourage you to read through these articles and the practitioner article by Smith, which examines the use of higher-order thinking skills in developmental education. We also have our second column of the Research Digest and I also invite you to enjoy our Web Scan and the Resource Reviews. Finally, as many of you may have heard, I will be stepping down as editor in December 2014 after the third issue for this year and we have launched the request for proposals for a new editor. If you or someone you know is interested and would like to learn more, please visit http://goo.gl/i0wyjf. If there is something you would like to see in the journal, please feel free to contact me at journal@coabe.org.

Enjoy!

Jim Berger,
Editor

JOURNAL OF RESEARCH AND PRACTICE FOR ADULT LITERACY, SECONDARY, AND BASIC EDUCATION

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Mission Statement

The Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education is published jointly three times a year by the Commission on Adult Basic Education and Western Kentucky University. The journal's mission is to provide a forum for sharing research, information, theory, commentary, and practical experiences that will improve the quality of services for adult basic education, literacy, and numeracy learners. These learners are found in publicly funded ABE, ESL, and GED programs; volunteer-based literacy programs; community-based literacy programs; family literacy programs; workplace literacy programs; correctional literacy programs; and many other places.

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The Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education is published three times per year. You can subscribe anytime during the year. Subscriptions will begin with the first issue after your form has been processed. You can subscribe to the journal online by visiting **joincoabe.org** and clicking on Journal or by scanning this QR Code with any bar code reader.

CONTRIBUTORS

Dr. Andrea Bergman received her bachelor's degree in 1984 from Cornell University, where she majored in Human Development and Family Studies. She went on to receive her PhD in clinical psychology from Emory University in 1989 after completing an APA approved internship at the University of Alabama at Birmingham – Medical Consortium. She then worked at Elmhurst Hospital Center and Mount Sinai Hospital on the schizophrenia research unit. In 1992 she joined the faculty in the psychology department at St. John's University and was awarded tenure and promotion to Associate Professor in 1998. Dr. Bergman's current research interests are focused on the application of empirically validated treatments for underserved populations, such as "disconnected" emerging adults who are experiencing multiple problems such as trauma exposure, severe mental illness and substance abuse.

Dr. Katherine Binder is a professor in the Psychology and Education Department at Mount Holyoke College. Her research interests include how skilled readers use various sources of contextual information in the service of word recognition and comprehension, how functionally illiterate adults acquire literacy skills, and more recently, how children learn to read. Her research on adult literacy students is supported by a grant from NICHD and her work with beginning readers is supported by a grant from IES

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Dr. Grace Kong is an Associate Research Scientist at Yale University School of Medicine. She obtained her BA in Psychology and Anthropology from the University of Rochester and a PhD in Clinical Psychology with specialized training through the Child and Adolescent Track at St. John's University. She also completed a National Institute on Drug Abuse (NIDA) funded T32 postdoctoral fellowship in the Department of Psychiatry at Yale. Her research goals are focused on trying to understand ethnic/racial disparities in adolescent smoking, as well as developing a culturally sensitive tobacco cessation program for adolescents in school settings.

Rebecca Metzger is a doctoral student at Marshall University's College of Education and Professional Development with a major in Curriculum and Instruction. She holds Masters' degrees in Special Education and Counseling. Currently, she works for RESA 3 in the field of adult basic education as a Technology Integration Specialist and instructor. Rebecca is also a licensed social worker and internationally certified advanced alcohol and drug counselor. She is a board member of the West Virginia Adult Education Association and West Virginia Certification Board for Addiction and Prevention Professionals.

Andres Muro has over 23 years of experience in the field of Adult Basic Education. He is currently the Director of the Community Education Program at El Paso Community College and a PhD candidate in Teaching Learning and Culture at the University of Texas at El Paso. He has published a Spanish GED textbook and several articles in the area of Adult Basic Education.

Dr. Alice W. Pope received BA, MS, and PhD degrees in psychology from The Pennsylvania State University. An Associate Professor of Psychology at St. John[1]s University, she has held faculty appointments at Texas Tech University and New York University School of Medicine. Her research focuses on developmental processes affecting social a nd psychological adjustment in normative and medical populations.

Dr. Sharon Reynolds is the Educational Specialist for the Office of Rural and Underserved Programs at the Ohio University Heritage College of Osteopathic Medicine. She earned her BS in Elementary Education/Deaf Education from The State College of New Jersey, her M.S. in Curriculum and Instruction from Virginia Polytechnic Institute and State University and her EdD from Ohio University. As

CONTRIBUTORS

Director of Adult Basic and Literacy Education Stevens Literacy Center, Dr. Reynolds led the work of the Central/ Southeast Adult Basic Literacy Education (ABLE) Resource Center, whose staff provides expertise in learning disabilities and professional development support to ABLE programs state-wide. Dr. Reynolds is the Educational Specialist for the Office of Rural and Underserved Programs at the Ohio University Heritage College of Osteopathic Medicine. She earned her B.S. in Elementary Education/Deaf Education from The State College of New Jersey, her M.S. in Curriculum and Instruction from Virginia Polytechnic Institute and State University and her Ed.D. from Ohio University. As Director of Adult Basic and Literacy Education Stevens Literacy Center, Dr. Reynolds led the work of the Central/ Southeast Adult Basic Literacy Education (ABLE) Resource Center, whose staff provides expertise in learning disabilities and professional development support to ABLE programs state-wide.

Dr. Jeff Ritchey is an Associate Professor of Adult and Community Education at Indiana University of Pennsylvania and coordinates the department's master's degree program in Adult Education and Communications Technology. His recent research has focused in two areas: first, the application of technology and new media in non-formal (non-school) educational initiatives (including collaborative projects examining training among journalists in Jakarta, Indonesia, and the use of technology in community programs by Indonesian Islamic boarding schools); and second, professional identity development among non-formal educators, specifically examining the experiences of administrators and teachers in rural county correctional facilities. Dr. Ritchey is author of The Role of Religion in Shaping the Rural Context (Edwin Mellen Press, 2002) and editor of Adult Education in the Rural Context: People, Place and Change (Jossey-Bass, 2008). In addition, Dr. Ritchey serves as co-editor (with Dr. Gary Dean) of the PAACE Journal of Lifelong Learning published through the Pennsylvania Association for Adult Continuing Education.

Dr. David J. Rosen directed the Adult Literacy Resource Institute at the University of Massachusetts in Boston for thirteen years. As an education consultant since 2003, he has provided assistance to, among other organizations: Portland State University's national Learner Web project; Massachusetts Department of Elementary and Secondary Education to develop a state adult basic education technology plan; Massachusetts Central SABES RSC to create professional development workshops and modules on integrating technology in the classroom; McDonald's Corporation's distance education ESOL program for immigrant restaurant workers; and Health Care Learning Network, a distance education workplace basic skills and college preparation program for health care workers.

Dr. Daniel A. Showalter is a visiting assistant professor in the math department at Ohio University where he is finishing a PhD program in curriculum and instruction with a specialization in mathematics education. His research interests include adult basic education, place-based mathematics education, educational equity, rural education, and statistical literacy. Daniel has taught in K–12 and post-secondary institutions domestically and in South Korea. As a quantitative analyst, Daniel works with the Rural School and Community Trust, a national non-profit organization addressing the relationship between rural schools and communities. He is coauthor of a textbook for a post-Algebra II alternative to Precalculus.

Dr. Regina O. Smith is an Associate Professor at UW-Milwaukee. She graduated from Michigan State University in Higher Adult and Lifelong Education.

Amani Talwar will be pursuing a PhD in Educational Psychology at Georgia State University. She earned a Bachelor of Arts degree in Psychology and Education from Mount Holyoke College.

Chelsie Wollett received her Bachelor of Science in Integrated Mathematics Education from Ohio University in 2009. During her time as an undergraduate, she worked with Dr. Martin J. Mohlenkamp on a National Science Foundation grant. As part of her research, she presented at the Nebraska Conference for Undergraduate Women in Mathematics in 2008. She earned her Master of Science in Mathematics from Ohio University in 2011. As Program Coordinator/Trainer for the Stevens Literacy Center, Chelsie developed curricula for math instructors in ABLE, given workshops on upper level algebra and geometry, and created professional development opportunities using Khan Academy.

Share your research and experience with your peers by submitting an article to the COABE Journal. For more information, contact COABE Journal editor, Jim Berger (**journal@coabe.org**). Please note that we accept manuscripts year round. Visit **coabe.org** and click on Journal to find out more information on how to submit a manuscript.

General Education Development (GED®) Credential Attainment, Externalizing Disorders, and Substance Use Disorders in Disconnected Emerging Adults

Dr. Andrea Bergman
St. John's University

Dr. Grace Kong
Yale University

Dr. Alice Pope
St. John's University

ABSTRACT

There are many benefits for emerging adults, both financial and personal, in obtaining a General Education Development (GED®) credential (Ou, 2008). However, little is known about the correlates of GED® credential attainment in "disconnected" emerging adults attending GED® programs. Our goal was to examine whether externalizing disorders, including attention-deficit hyperactivity disorder, substance use disorders, and antisocial personality disorder, predicted GED® credential attainment in a sample of 109 emerging adults attending a GED® program. Included in the analysis was age, ethnicity, gender, and measures of both verbal and non-verbal intelligence. Results of logistic regression analysis indicated that verbal IQ was predictive of GED® credential attainment. These results are consistent with previous literature linking childhood IQ and educational achievement (Fergusson, Horwood, & Ridder, 2005b).

INTRODUCTION

One of the greatest educational and economic barriers to success for emerging adults is failure to complete high school. Emerging adulthood, a unique developmental period occurring between ages 18 and 29, differs from adolescence and young adulthood in terms of demographics, subjective experience, and identity exploration (Arnett, 2000). Disconnected youth have been defined as those who have previously disengaged from school and/or the workforce for some period of time and are therefore more likely to suffer long-term negative consequences (Besharov, 1999; Hair, Moore, Ling, McPhee-Baker, & Brown, 2009). Emerging adults who do not complete high school will have difficulty making the transition to the adult world in terms of employment, earnings and family formation (National Center for Education Statistics, 1996). Over 600,000 high-school drop-outs complete the General Education Development (GED®) test yearly (American Council on Education, 2012), but over 60% of GED® students are unsuccessful in obtaining

this credential (Dynarski & Gleason, 2002). There are many benefits for those who have obtained GED® credentials, including greater quarterly income and greater life satisfaction (Ou, 2008). Unfortunately, little research has been conducted on the possible correlation between the successful completion of the GED® credential and variables related to mental health in this "disconnected" population, despite some evidence linking mental disorders and termination of schooling (Breslau, Lane, Sampson, & Kessler, 2008). Despite clear evidence of pressing needs, this population is under-researched, possibly because of the difficulty in obtaining samples among alienated and disengaged youth. The goal of this study was to examine possible mental health correlates (i.e., externalizing disorders, including attention-deficit hyperactivity disorder, substance use disorders, and antisocial personality disorder) of successful GED® credential attainment in a sample of disconnected emerging adults who dropped out of high school and were attending a GED® program.

Research with GED® Students

While there have been little to no studies examining the mental health correlates of GED® credential attainment, a review of the literature on GED® program success and educational achievement (especially school drop-out) will help to shed light on both the importance of the research topic and the relevance of the particular mental health correlates that we have chosen to study. Some research exploring educational factors associated with GED® credential attainment has identified barriers as self-reported by the participants attending the GED® programs. In a study of emerging adults currently enrolled in GED® programs, Reio, Marcus, and Sanders-Reio (2009) examined social relations and attachment styles in relation to GED® credential completion. They administered measures of school-based relationship attachment (self-reported assessments of student-student friendships and student-instructor relationships) and a general attachment style measure (self-reported forced choice measure of attachment style) using 244 participants whose ages averaged 18.6 years old. The authors found that positive relationships with other students and instructors, as well as secure attachment styles, were significantly related to successful completion of the GED® credential (Reio et al., 2009).

Another study surveyed current participants in 11 GED® programs in the southern part of the United States using the Deterrents to Participation Scale (DPS), measuring nine potential barriers to GED® participation (King, 2002). This study was limited due to the specific items examined in this scale, which were identified as: course quality, perceived inability, time constraints, motivation, family constraints, logistical barriers, personal priorities, learning styles, and physical barriers. According to the author, the nine barriers accounted for 50% of the variance in GED® outcome. Based on his analysis, King concluded that deterrents to participation in adult education programs for high school dropouts is multidimensional and required analysis of barriers among different subgroups (e.g., male versus female, urban versus nonurban students) in order to fully understand the construct.

Research on School Drop-Out

Substance use associated with school drop-out. Since little research has been conducted exploring the predictors of GED® credential attainment for emerging adults, it is relevant to examine research addressing factors associated with school drop-out, such as negative outcomes associated within this population. Substance use and abuse is one factor

considered to be both a cause and consequence of school drop-out. From a developmental perspective, emerging adults have the highest prevalence rates of most types of substance use. According to the National Survey of Drug Use and Health (SAMHSA, 2012), drug use in the past month (21.4%) and prevalence of diagnoses of substance abuse/dependence (18.6%) was highest for 18 to 25 year olds. Unfortunately, one of the many adverse consequences associated with increased substance use in youth is reduced educational attainment. For instance, in an analysis of the data from the National Longitudinal Study of Adolescent Health, Broman (2009) concluded that the use of marijuana in adolescence was associated with lowered educational achievement by young adulthood. The study was replicated with youth from Australia (Horwood et al., 2010) and related to increased economic costs (i.e., lower labor income) due to late graduation from schools associated with binge drinking (Renna, 2007). It is clear that adolescent use of alcohol and drugs is associated with decreased educational attainment, including high school graduation. The research investigating whether educational status (e.g., college attendance) was a risk factor for increased drug and alcohol use for emerging adults is less consistent.

Research has found that emerging adults attending college may or may not have more problems with substance use than those not attending college. Slutske et al. (2004) found that college student women drank more, participated in binge drinking, and were drunk more frequently than non-college attending women aged 19-21. These findings were consistent with studies that found college students reporting that they were more likely to have drank heavily in the past 30 days than their non-college attending peers (e.g., Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002), but inconsistent with other studies reporting no differences (e.g., Gfroerer, Greenblatt, & Wright, 1997) or less binge drinking for college students (e.g., Muthen & Muthen, 2000). When diagnosable alcohol use disorders were examined, even studies finding increased drinking behavior in college students did not find increased rates of alcohol use disorders compared to their non-college attending peers (Slutske et al., 2004).

Substance use is not only related to poor academic achievement. There is also evidence that the long term trajectory of substance use disorders might be far worse for individuals who have dropped out of high school than for those with higher levels of education. Longitudinal studies that followed individuals well into their 30's found that individuals who did not complete high school had more substance related problems later in life than high school and college graduates (Harford, Yi, & Hilton, 2006; Muthen & Muthen, 2000). While the differences in current substance use between college samples and those who did not attend college varies among studies, dropping out of high school was associated with increased long-term risk of alcohol related problems when studied well into adulthood (Harford, Yi, & Hilton, 2006; Muthen & Muthen, 2000) For instance, Muthen and Muthen (2000) found that alcohol related problems did not differ at 25 years of age among individuals who dropped out of high school, graduated high school, and attended college; however, alcohol related problems increased by the age of 37 for high school dropouts, whereas they decreased for high school and college graduates. A 10-year prospective study (Harford et al., 2006) found that dropping out of high school was associated with increased long-term risk for alcohol dependence; however, educational status beyond high school was a protective factor

against the development of alcohol dependence. These associations remained statistically significant even after controlling for early behavioral problems.

Externalizing disorders and school drop-out. Externalizing behavior disorders (attention-deficit/hyperactivity disorder, oppositional defiant disorder, conduct disorder/antisocial personality disorder) are inextricably linked to substance use and abuse throughout adolescence and emerging adulthood. This cluster of disorders has also been associated with poor educational outcomes and would therefore be a logical choice for investigation as a correlate to GED® credential attainment. Using data from a large, nationally representative survey of the US adult population, Breslau et al. (2008) examined the association between 17 disorders (diagnosed with Diagnostic and Statistical Manual – 4th edition, DSM-IV) and early school termination. They found that disorders involving externalizing behaviors (e.g., conduct disorder, ADHD, substance use disorders) were more consistently associated with termination of schooling than were disorders that involve internalizing behaviors (e.g., major depression, generalized anxiety disorder). This is similar to the findings of other studies that followed clinical samples of children with externalizing disorders (e.g. Klein et al., 2012).

A recent study examining the long-term outcome of children diagnosed with attention deficit/hyperactivity disorder (ADHD) found that 31% of those with ADHD did not complete high school, while only 4% of the comparison participants failed to complete high school (Klein et al., 2012). A prospective, longitudinal study found that both ADHD and conduct disorder were associated with academic difficulty after a 5 year follow-up of girls diagnosed with ADHD (Monuteaux, Faraone, Gross, & Biederman, 2007). Another prospective study found that boys with ADHD failed a greater number of academic classes in junior high and high school compared to boys without ADHD (Mannuzza, Klein, & Moulton, 2002). Boys with ADHD also tend to complete fewer years of formal schooling than boys without ADHD (Mannuzza, Klein, Bessler, Malloy, & Hynes, 1997; Mannuzza et al., 2002). In a sample of over 150 adolescents, 25% of the ADHD group dropped out of high school whereas only 1% of the non-ADHD group dropped out of high school (Mannuzza et al., 1997).

Given previous research linking externalizing disorders, substance use disorders, and academic difficulties, the goal of this study is to examine whether these factors are associated with GED® credential attainment in a sample of emerging adults enrolled in a GED® program. Specifically, we predicted that ADHD, antisocial personality disorder, and substance use disorders (alcohol, marijuana, cocaine use disorders) would be associated with GED® attainment while controlling for demographic variables such as ethnicity, gender, and age. We have also included a measure of intelligence (IQ) as a predictor based on previous research indicating that childhood IQ is correlated with later academic success, while childhood conduct problems were not related (Fergusson, Horwood, & Ridder, 2005a; Fergusson, Horwood, & Ridder, 2005b).

METHOD

Participants

The participants in this study were 109 emerging adults (67 males and 42 females) between 16 and 21 years old *(*M=17.98, SD=0.93*)* recruited from a General Education Diploma (GED) program in New York City. Since these students have previously dropped out of high school, they may be especially likely to manifest behavioral and substance use

problems. The sample was ethnically diverse, with approximately 46% of the participants identifying themselves as Hispanic, 18% as African-American, 13% as Caucasian, and 5% as Asian. The remaining 18% identified their ethnicity as "other" or chose not to provide that information.

Measures

Demographics. The self-report demographic questionnaire included participant's age, sex, ethnicity, and last grade completed.

Modified ADHD Interview for Adolescents. The Modified ADHD Interview for Adolescents is a modified version of the Schedule for Affective Disorders and Schizophrenia for School-aged Children (K-SADS; Orvaschel & Puig-Antich, 1987), which is a semi-structured interview for diagnosing Axis I psychiatric disorders in children and adolescents. The original K-SADS interview was supplemented with additional age-appropriate questions (Gittelman & Mannuzza, 1985) in order to best assess the presence of ADHD symptomatology in the present sample of emerging adults. For example, one of the K-SADS suggested questions for the "difficulty organizing tasks" symptom of inattention ("Is your desk or locker at school a mess?") was replaced with the question worded, "Do you have difficulty organizing your activities or responsibilities?" from the Gittelman and Mannuzza (1985) interview. Because the K-SADS is a semi-structured instrument, the addition of questions to assess the symptoms outlined in the ADHD module should not have negatively impacted the validity of this measure. Further, whereas the K-SADS instructions allow for the interviewer to choose among the suggested probes in order to assess presence of symptoms, we chose to use the specific list of questions outlined in the Gittleman and Mannuzza (1985) interview in order to increase the uniformity of study procedures. The final questions chosen from both measures were reorganized to go along with the symptoms they sought to assess, into two sets of nine that directly correspond to the DSM-IV criteria for the inattentive and hyperactive-impulsive subtypes of ADHD. After the interview was completed, each of the 18 possible DSM-IV symptoms were rated for severity by the interviewer on the Gittelman and Mannuzza (1985) severity scale: 1=none, 2=mild, 3=moderate, 4=severe, 5=extreme. An item was considered clinically significant if it was rated a 3 (moderate severity) or higher, with a score of 3 being significant to endorse the presence of that symptom. All interviewers for this measure were trained doctoral students in clinical psychology with practicum experience in clinical interviewing. Selected interviews were recorded, with the participants' knowledge and written consent, and checked for reliability purposes by additional raters (n=10). The mean (standard deviation) percent agreement on ADHD diagnosis across raters was 94.44% (16.67).

The Parents' Rating Scale (PRS; Ward et al., 1993). This scale is a questionnaire adapted from the Connors' Abbreviated Teacher Rating Scale, which was administered to the parent or other informant for the participant with ADHD. This questionnaire was read to the informant over the telephone and ratings were obtained for two time periods: when the participant was 6-10 years old and at his or her current age. Ward et al. (1993) reported concurrent validity between the Wender Utah Rating Scale and the Parents' Rating Scale with a correlation coefficient of .41 for ADHD participants. For the current study, 15 questions from the Attention Deficit Hyperactivity subscale of the Schedule for Affective Disorders and Schizophrenia-Child Scale (K-SADS; Orvaschel & Puig-Antich, 1987) were added in an effort to increase the sensitivity of the measure. A

total of 25 questions were administered and rated on a scale of 0 (not at all) to 3 (pretty much). The results of the parent/informant interview were used in conjunction with the participant's information to confirm the presence of at least 6 of the 25 symptoms at a clinically significant level, in order to confirm a diagnosis of ADHD.

Structured Clinical Interview for DSM-IV: Non-Patient Version (SCID-NP; First, Spitzer, Gibbon, & Williams, 1996). The Axis-I portion of the SCID was administered in order to assess whether participants met criteria for a (current or past) psychoactive substance use disorder and (current or past) depressive disorder. This interview is designed to deliver accurate diagnoses using the Diagnostic and Statistical Manual of Mental Disorders 4th edition–Text Revision (DSM-IV, TR; APA, 2000) and is commonly used in both research and clinical settings. For this study, diagnosis of alcohol use, cocaine use or marijuana use disorder was made if a participant met all of the DSM-IV-TR criteria for either abuse or dependence on the relevant substance, as specified in Disney, Elkins, McGue, and Iacono (1999). The individual was considered to have a depressive disorder if he/she met criteria for either a major depressive disorder or dysthymia. Selected interviews were recorded, with the participants' knowledge and written consent, and checked for reliability purposes by additional raters (n=10). The mean (standard deviation) percent agreement for substance diagnosis across raters was 95.83% (14.43); for depression was 98.9% (5.98).

Structured Clinical Interview for the DSM-IV Axis II Personality Disorders (SCID-II; First et al., 1996). The SCID-II interview is designed to deliver an accurate DSM-IV-TR (APA, 2000) diagnosis of Antisocial Personality Disorder (APD) which requires some consistency in symptom presentation over the life course (criterion D) and so covers recent (after the age of 15 years) as well as childhood (prior to age 15 years) symptoms along the antisocial/conduct disorder spectrum. For the present study, a dimensional scoring approach was utilized in which each symptom was scored as 0 (absent), 1 (subthreshold), or 2 (present) and then summed to create a total APD score (Gude, Monsen, & Hoffart, 2001), which was then used for a diagnosis of APD according to the DSM-IV-TR. The scoring of each APD symptom was reviewed and confirmed during consultation with a licensed clinical psychologist (A.B.). This dimensional scoring approach has been shown to be a far more reliable estimate than the traditional categorical method in the literature (Loranger et al., 1994). Internal consistency for this dimensional APD score in the present study was good, α=.88 and mean (standard deviation) percent agreement for APD diagnosis was 96.67% (10.54).

Kaufman Brief Intelligence Test (KBIT, Kaufman and Kaufman, 1990). This is a brief, individually administered measure of verbal and nonverbal intelligence. It takes 15-30 min to administer and consists of 2 subtests, Vocabulary and Matrices. It yields an overall composite score as well as scores on each subtest to yield both a verbal and non-verbal measure of intelligence. For purposes of this study, both subtest scores were used individually since this sample was composed of an almost 50% Hispanic sample who may have been raised in a primarily non-English speaking home, which could potentially result in an underestimate of verbal intelligence. As reported by Kaufman and Kaufman (1990), both the Vocabulary and Matrices subtest are reported to have excellent split-half reliability for adults (mean=.97 and .94 respectively).

GED Completion. This was determined through an examination of archival records at the GED® program as well as from results published by the New York State Board of Education, which is consistent

with previous research on GED® attainment (Reio et al., 2009). This was reviewed every year for five years after initial data was collected in order to ascertain whether students leaving the GED® program were successful in obtaining their GED® credential elsewhere.

Procedures

Participants were initially recruited from their classrooms or at intake into the GED® program. Students were under no obligation to participate and all willing participants were awarded a small stipend for their participation. Participation in the study consisted of completing self-report questionnaires, a clinical interview, and a brief cognitive test with a trained doctoral student in clinical psychology. Sessions typically lasted approximately two hours. The study procedures described above were reviewed and approved by the University Institutional Review Board and the GED® program prior to the collection of any data.

For the participants who endorsed six or more ADHD symptoms, several attempts were made to obtain parent (or other guardian such as grandparent, aunt, etc.) confirmation of these symptoms prior to seven years of age, including several telephone calls and mailing questionnaires with self-addressed stamped envelopes. The majority of parents were not able to be interviewed because they either did not respond or did not speak English (68%). Of the 32% who did respond, all of them confirmed the presence of ADHD symptoms prior to seven years of age. Due to the lack of parental response, criterion B (ADHD symptoms prior to age 7) was dropped as a necessary condition for classification of ADHD for the purposes of the present study. Final group classification (i.e., ADHD or non-ADHD) of each participant was later confirmed via group consensus meeting under the supervision of a licensed clinical psychologist (AB). Nineteen participants reported current symptoms consistent with an ADHD diagnosis (i.e., at least six symptoms in one of the specified categories, attention or hyperactivity/impulsivity). Only participants who reported fewer than three ADHD symptoms were included in the non-ADHD group, which consisted of 59 participants.

Description of Interviews

Participants seemed eager to discuss their experiences and appeared to appreciate the opportunity to talk about factors affecting their lives. They seemed comfortable revealing how often they used and abused substances. Several participants informed interviewers that during lunchtime it was routine for students to "get high" down the street from school. Another factor that participants repeatedly discussed was their almost universal experiences with community violence and other traumas. For example, while students all agreed that the school environment was exceptionally safe, many had both witnessed and experienced muggings, shootings, domestic violence, and child abuse, to name a few. It became apparent that these emerging adults enjoyed the time that we took to sit and listen to their perspective and were more than happy to tell us about their lives and their experiences.

Data Analysis

We conducted data analyses using Predictive Analytics Software (PASW) version 18 (SPSS, 2009). Descriptive analyses examined demographic information, substance use disorders (alcohol, marijuana, cocaine), and externalizing disorders (ADHD, conduct) among all emerging adults. Chi-square and t-tests assessed whether study variables differed between those with complete data, missing data, and between GED® status and non-GED status.

An individual was coded as having an alcohol use, cocaine use or marijuana use disorder if he or she met all of the DSM-IV criteria for either abuse or dependence on the relevant substance, as specified in Disney et al. (1999).

Those with complete data were selected for logistic regression analyses to assess the predictors of GED® attainment. The independent variables were gender, age, Hispanic ethnicity, alcohol use disorder, marijuana use disorder, cocaine use disorder, ADHD, conduct disorder, and IQ measures (KBIT determined verbal and non-verbal subtests scores). We also conducted the logistic regression analyses with continuous symptom variables for all substance use disorders and externalizing behavior disorders. The results were comparable to the model with diagnoses (categorical variables) as independent variables; therefore, we presented the findings based on the diagnoses derived from the SCID interviews. To correct for multiple comparisons in the logistic regression model, Bonferroni determined p-values equal to or less than 0.005 were considered statistically significant.

RESULTS

Of the total of 109 participants, 70.6% (n=77) with complete data were included in the analyses. Those with complete data and missing data did not differ on demographics, externalizing disorders (ADHD, antisocial personality disorder) and substance use disorders (alcohol, cocaine). Those with complete data were more likely to have marijuana use disorder (42% vs. 20%, χ^2 (1, N=102) 3.79, p=.05) and obtain their GEDs (65% vs. 39%, χ^2 (1, N=105) 5.55, p=.02) compared to those with missing data. There were 52% of our participants with at least one of the substance use disorders (alcohol, marijuana, cocaine), 25% had ADHD and 22% had APD.

Table 1 shows descriptive information on all study variables among total participants and separated by GED® credential attainment status. GED® credential attainment and non-GED credential attainment did not differ in age, Hispanic ethnicity, substance use disorders, externalizing disorders and KBIT mathematics scores. GED® credential status was associated with female gender and higher KBIT vocabulary score.

Table 2 shows the results of logistic regression modeling GED® credential attainment vs. non-attainment as the dependent variable. Demographics, substance use disorders, ADHD, antisocial personality disorder, and IQ measures were independent variables. Only KBIT vocabulary score was significantly associated with GED® credential attainment, OR=1.16, 95% CI (1.05, 1.28).

DISCUSSION

The goal of this study was to examine factors associated with GED® credential attainment, in a sample of disconnected emerging adults attending a GED® program in an inner-city neighborhood. Specifically, it was predicted that ADHD, APD, and substance use disorders would be negatively associated with GED® credential attainment. In contrast, the results indicated that only the KBIT Vocabulary subtest was significantly associated with GED® credential attainment in this sample of emerging adults.

They also reported that conduct problems in childhood were not predictive of educational achievement after controlling for factors such as adversity and parental adjustment (Fergusson et al., 2005a). This is consistent with our findings that the disorders examined (ADHD, APD, SUD) were not significantly associated with GED® attainment; however, much of the previous literature has suggested that problems such as ADHD, APD and SUD are linked with lower educational achievement

Table 1—*Characteristics of emerging adults separated by GED® attainment status.*

	Total (N=77)	GED (n=50)	No-GED (n=27)	χ^2/t-test
Sex (%)				
Female	42.9	34.0	59.3	4.57*
Age (M,SD)	18.0, 0.97	17.88, 1.00	18.26, 0.86	1.66
Hispanic (%)	50.6	50.0	51.9	0.02
KBIT- Vocabulary (M,SD)	83.88, 9.42	87.22, 7.68	77.70, 9.34	-4.81**
KBIT- Matrices(M,S)	92.88, 11.10	94.56, 11.98	89.78, 8.62	-1.83
ADHD (%)	24.7	28.0	18.5	0.85
Antisocial PD (%)	22.1	28.0	11.1	2.91
Alcohol Use Disorder (%)	31.2	38.0	18.5	3.10
Marijuana Use Disorder (%)	41.6	42.0	40.7	0.01
Cocaine Use Disorder (%)	9.1	12.0	3.7	1.46

* $p \leq .05$, **$p \leq .01$

Table 2—*Predicting GED® attainment from IQ, externalizing disorders, and substance use disorders*

	OR	95% CI
Sex	0.24	0.06, 1.05
Age	0.85	04, 1.69
Hispanic	1.11	0.31, 3.90
KBIT- Vocabulary	1.16*	1.05, 1.28
KBIT- Mathematics	1.01	0.96, 1.08
ADHD	0.26	0.04, 1.88
Conduct Disorder	3.43	0.27, 43.01
Alcohol Use Disorder	2.25	0.34, 15.04
Marijuana Use Disorder	0.19	0.04, 0.99
Cocaine Use Disorder	21.99	0.83, 580.13

Note: Bonferroni correction was applied for significance testing. * $p \leq .005$, OR=odds ratio, CI=confidence interval , * $p \leq .05$, **$p \leq .01$

(Monuteaux et al., 2007; Horwood et al., 2010; Klein et al., 2012). Fergusson et al. (2005a; 2005b) pointed out that many of the findings linking conduct problems and educational achievement (as well as the findings linking IQ and later adjustment) can be explained using a "dual pathway" model (Fergusson & Horwood, 1995; Fergusson, Lynsky & Horwood, 1997). In this model, early conduct problems were associated with later adjustment and early IQ was predictive of later educational achievement. Given the nature of the emerging adults sampled in this study, both conduct problems and IQ are likely relevant.

This is further illustrated by the high percentage of self-reported disorders acknowledged by our participants. As can be seen in Table 1, our

participants reported fairly high rates of ADHD (25%), APD (22%), Alcohol use disorders (31%), Marijuana use disorders (42%) and Cocaine use disorders (9%). Since a diagnosis requires that participants report symptoms that either interfere with functioning or cause significant distress, it is clear that these results would indicate another area, along with assistance in cognitive areas, where these emerging adults would benefit from intervention.

The limitations of this study should be considered when interpreting the findings. This study is limited by the small sample size, missing data, and restricted access to one GED® site. Despite these limitations, we were still able to identify a statistically significant association with GED credential attainment (Verbal IQ score) that is consistent with previous literature and theory. Although the sample size is restricted, the participants in the study represent a low-income, ethnically diverse population of emerging adults who have dropped out of high school. They are a vulnerable, difficult-to-reach community sample who are more likely to be poor, have mental health problems, be involved with violence, and be at risk for long term consequences (Hair et al., 2009). The practical difficulties of recruiting individuals who dropped out of high school have discouraged researchers from studying these at-risk emerging adults, providing little research on outcomes such as GED® credential attainment. Another factor with this population might have been the use of quantitative data methods. Our current research has indicated that the use of qualitative methods might be more fruitful when seeking information from individuals who are disenfranchised, such as the current sample. Based on the results of these interviews, it appears that our participants responded quite favorably to discussing their experiences and were willing to answer personal questions regarding the nature of their problems. As a result of this data, we have now been engaging in qualitative research and have found that these methods, such as focus groups, have provided rich information regarding perceived barriers to GED® completion in disconnected emerging adults (e.g., Bergman et al., 2013). These methods may not only elucidate the perceived factors contributing to academic success and failure in this population, but may also shed light on the difficulty in quantifying the predictors of academic outcomes in the present study.

The present research confirms previous studies indicating that scores on standardized IQ tests are predictive of performance on GED® tests; thus, areas of intervention should perhaps focus on tasks that will help students perform on such areas of cognitive performance. In addition, these participants reported longstanding symptoms of several disorders that, by definition, are interfering with their functioning and could benefit from intervention. Based on our quantitative and qualitative research with this emerging adult population, we have begun to develop an intervention called Risk Reduction for Independence Therapy (RRIT; Bergman, Danielson, & Brown, 2008), focusing on substance abuse and exposure to trauma, integrating empirically validated treatments, such as trauma-specific cognitive behavior therapy (e.g. Foa et al., 2005) and multi-systemic therapy (e.g. Henggeler, Schoenwald, Rowland, & Cunningham, 1998). Given the transitional nature of emerging adulthood, this could be an ideal time for an effective intervention for these individuals. ❖

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Teaching a High-Level Contextualized Mathematics Curriculum to Adult Basic Learners

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ABSTRACT

This paper reports on the implementation of a high-level contextualized mathematics curriculum by 12 adult basic instructors in a midwestern state. The 10-week pilot curriculum embedded high-level mathematics in contexts that were familiar to adult learners. Instructors' weekly online posts were coded, and the following themes emerged: (a) relevancy of content and context was the most-cited facilitator in overcoming difficulties associated with learning high-level mathematics, (b) instructor adaptations of the curriculum shifted from reactive to proactive as they began contextualizing content independently, and (c) according to instructors' reports, adult learners grew more proficient in connecting mathematics with their life experience while instructors adopted a more interactive teaching style. Implications for adult basic education are discussed.

INTRODUCTION

In the first half of the 20th century, U.S. mathematics curricula centered on abstract content and procedures, with the assumption that students would naturally transfer the concepts to their lives as needed. However, in the mid-to-late 20th century, studies began to shed doubt on the transferability assumption in mathematics (Chase & Simon, 1973; Masingila, 1992). Research suggested the importance of experiential knowledge within a domain, a hypothesis that was supported by similar studies in a wide range of fields (Collins, Brown, & Holum, 1991; National Research Council, 2012; Perkins & Salomon, 1989; Schoenfeld & Herrmann, 1982).

Contextualizing mathematics for adult learners in basic education programs has been recommended by policymakers and educators for the past couple decades (see Curry, Schmitt, & Waldron, 1996; see also Lepicki, Glandon, Austin, Wonacott, & Vlach, 2009). This is not a simple task. Yet, many adult basic educators are left to develop their own curricula for teaching mathematics. This is problematic for several reasons: (a) Many adult basic educators have weak backgrounds in mathematics (Coben, 2003; Gal, 2002; Schmitt, Bingman, & Curry, 2009); (b) most adult basic educators have not had professional training in mathematics education and are unsure of what to teach or how to teach it (Condelli et al., 2006; Sherman et al., 2006); (c) many adult basic instructors are part time and lack the time and professional training to prepare high-quality lessons (Condelli et al., 2006); and (d) K–12 textbooks rarely account for the significant differences between

K–12 students and adult learners (Masingila, 1992; Northeast Ohio ABLE Resource Center, 2008).

To address these challenges in the state's Adult Basic and Literacy Education (ABLE) system,[1] a statewide committee was formed to consider the feasibility of implementing a model curriculum. Curriculum development occurred in three phases: a pilot curriculum, a field test curriculum, and a revised comprehensive curriculum. Data collection and analysis from each stage informed adaptation of the curriculum in subsequent phases. This article details the study surrounding the pilot curriculum. We considered three research questions during the pilot study:

1. What are the main barriers and facilitators to implementing a high-level contextualized mathematics curriculum for adult learners?
2. In what ways do instructors adapt the curriculum?
3. What do instructors report as the outcomes of using the curriculum?

To answer these questions, math instructors from ABLE programs across a midwestern state were selected to implement the pilot curriculum over a 10-week period. The instructors posted weekly reflections and responses on an online discussion board. Their posts were then coded, and the resulting themes described in the results section.

LITERATURE REVIEW

There is a paucity of peer-reviewed research on adult basic mathematics (Coben, 2003; Condelli et al., 2006) and less research about the curricula used in adult basic mathematics classes. Extant publications are largely theoretical, underscoring the need for empirical research (Sherman et al., 2006). Although empirical studies on K–12 mathematics curricula can be informative about adult learners, the two populations are different, and results from one cannot be blindly generalized to the other (Safford-Ramus, 2009). The following research review is sensitive to this distinction, and anchors the research in the adult populations when available.

Research on Mathematics Curricula

Designing high-quality mathematics curricula has, presumably, been an implicit goal of curriculum designers; however, focused research on how mathematics curricula impacts learning was not conducted until the 1990s (Stein, Remillard, & Smith, 2007). Recent research has emphasized the gap between the written curriculum and student learning. Discrepancies can arise between the written curriculum (what is given to instructors), the intended curriculum (how instructors interpret the curriculum), the enacted curriculum (what occurs in the classroom), and student learning (what is actually learned) (Stein et al., 2007). Attempts by curriculum designers to "teacher-proof" curricula have proven to be ineffective and often counterproductive (Stein et al., 2007). Although much remains unknown about the connection between mathematics curricula and student learning, the research is clear that an informed and proactive instructor is invaluable to a curriculum's success (Stein et al., 2007). Instructors play a particularly important role in implementing contextualized curricula because they must incorporate content knowledge with life experience.

Curricula That Contextualize Mathematics

Contextualized learning has been cited as increasing transferability, attention, and motivation (Ku & Sullivan, 2002; Cordova &

[1]In this midwestern state, Adult Basic Education (ABE) is referred to as Adult Basic and Literacy Education (ABLE).

Lepper, 1996). Contextualizing problems teaches valuable life skills and facilitates the learning of abstract reasoning (Kalchman & Koedinger, 2005). Evans and Thorstad (1995) claimed that achieving numeracy is not even possible when mathematics is divorced from its natural contexts. Contextualized curricula attempt to bridge this gap by building on the life experience of adult learners.

Despite many potential benefits, contextualized mathematics curricula are rarely used in adult basic education (Ginsburg, Bickerton, Southwood, & Hinds, 2011). This lack of use can be attributed to at least three obstacles. First, a curriculum created *for* programs by external curriculum designers faces the danger of becoming static and less relevant, thus defeating a central purpose of using context (Shaikh, Tamim, & Bernard, 2007). Second, the time, energy, professional knowledge, and financing needed to develop contextualized curricula poses substantial barriers for most ABE programs (Cordova & Lepper, 1996). Third, the contextualization of problems has been shown to hinder student achievement when students are not sufficiently familiar with the contexts (Walkington & Sherman, 2012).

Díez-Palomar, Menéndez, and Civil (2011) engaged working-class parents of middle-school students in a series of informal mathematics workshops by using contexts from the parents' lives. They then interviewed 14 parents about the course. The overarching finding was that the contexts motivated the adults, increased understanding of mathematics, and helped them overcome anxiety. However, the researchers noted that parents were reluctant to explain their thought processes to the point where parents petitioned the researchers to discontinue the practice. This caveat serves as a reminder of the depth of anxiety certain adults may feel towards mathematics, even when the math is embedded in "friendly" contexts.

Curricula That Contextualize High-Level Mathematics

The challenges mentioned in the previous section arise when contextualizing any level of mathematics. Research has uncovered an additional difficulty when contextualizing high-level[2] mathematics: the content itself. One such study involved seven K–12 sites across the U.S. that were nominated as exemplars of contextualizing mathematics to the local area (Howley, Showalter, Howley, Howley, Klein, & Johnson, 2011). Researchers conducted field observations at each site and interviewed students, parents, teachers, administrators, and community members. Teachers at these sites were reportedly able to contextualize lower-level mathematical topics relatively easily. For example, one algebra teacher had students survey local forest plots, map the plots on a coordinate grid, and then learn algebra through analyzing the graphs. At another school, teachers taught conversions, proportions, and measurements through making stringed instruments. At six of the sites, however, teachers reported difficulties in contextualizing topics at the Algebra I-level and above. This same finding was confirmed in a follow-up study. Showalter (2013) interviewed 15 graduates of a mathematics education doctoral program that emphasized contextualizing mathematics. Participants included mathematics instructors at high schools, community colleges, and universities. Twelve of the 15 participants encountered the

[2]*High-level*, in this article, refers to National Reporting System (NRS) Educational Functioning Level (EFL) levels 5 and 6 of the state's ABE/ASE Standards. This is roughly equivalent to the mathematics learned in an Algebra I-Geometry-Algebra II sequence in high school.

same difficulties with contextualizing high-level mathematics as had the teachers in Howley et al.'s (2011) study, with the exception of statistics classes (i.e., most teachers reported being able to contextualize mathematics in their statistics classes).

Although the studies by Howley et al. (2011) and Showalter (2013) were focused on contextualizing mathematics to the local area, similar difficulties have arisen with contextualization of mathematics in general. In other words, there is a gap between the mathematics taught in school and the mathematics experienced in everyday life (Abreu & Cline, 2007; Civil, 2007; Masingila, 1992). The differences between abstract classroom mathematics and mathematics contextualized in the work force were detailed by FitzSimons and Wedege (2007), who studied adult numeracy in the chemical spraying and handling industry. They found that the mathematics used by the workers in their study differed substantially from classroom mathematics because workplace mathematics were invisible; shaped substantially by environmental constraints, and evaluated based on safety standards, financial interests, and client satisfaction. In lower-level topics such as counting, arithmetic, and measurement, this gap is much less evident than it is in higher-level topics such as polynomials, functions, and systems of equations. This is not to say that higher-level mathematics lacks real world connections; it simply tends to be more difficult, for students and instructors, to see these connections. In overlooking these connections, instructors not only forfeit an asset for helping learners understand the content, they also (perhaps unknowingly) send the message to learners that their life experience is irrelevant when it comes to mathematics (Abreu & Cline, 2007; Civil, 2007).

For all of the reasons listed in this section, it would be highly valuable to understand more about the factors involved in implementing and sustaining a curriculum that connects high-level mathematical topics with contexts relevant for adult basic learners.

METHODOLOGY

The development of the contextualized math curriculum can be broken into three stages: pilot, field test, and scale-up. The current study analyzed the pilot data in informing the field test and scale-up stages.

Participants

Participants for the pilot were selected through the following process. All ABLE program directors (N=65) in a midwestern state were invited by email to participate. Interested directors selected two instructors from their programs, each of whom had to meet a content knowledge prerequisite by passing the mathematics portion of the GED® Practice Exam. Six programs applied, and all 12 instructor applicants passed the screening test. Instructors varied in age (mid-20s to 70s) and sex (2 males, 10 females). Participants' K–12 teaching experience ranged from 2 years to 44 years (M=16 years), and their ABLE teaching experience ranged from 1 year to 22 years (M=7 years). Instructors represented geographical areas from around the state, and generally did not know other participants before the pilot (with the exception, in some cases, of their partner instructor). Each classroom contained up to 16 adult learners, whose Test of Adult Basic Education (TABE) assessment scores placed them between level 1 and level 6 of the National Reporting System's Educational Functioning Levels (NRS EFL); the mode classroom was between four and eight adult learners at levels 3–5.

Pilot Program

The pilot curriculum was written by two authors of

this article (Wollett and Showalter) and comprised nine lesson plans for approximately 20 hours of instruction time (one lesson plan was designed to take four hours; the others were designed to take two hours). Each lesson centered on one of four broad contexts (money, health, around the home, or games) and covered mathematical content from levels 5 and 6 of the NRS EFL Standards (roughly equivalent to grades 9–12 in the K–12 system). Lessons were sequenced so that mathematical prerequisites were covered in prior lessons. Pólya's (1945) problem-solving process[3] was described in one lesson, the use of manipulatives were suggested in six lessons, and explicit instruction steps were provided in all nine lessons. Table 1 shows the content and context of each lesson plan.

Participating instructors agreed to teach the curriculum over the course of the 10-week pilot while providing weekly feedback on an online discussion board.[4] The entire pilot group of program coordinators, participating ABE instructors, and program directors "met" on three occasions: an initial one-day face-to-face workshop, a two-hour midpoint conference call, and a two-hour final conference call. In addition, instructors were asked to observe their partner instructor on two occasions. Each observation was preceded by a planning conference, and followed up by a reflection conference. The instructors were asked to design a contextualized lesson plan by the end of the pilot.

Table 1—*Content and Context of Pilot Lesson Plans*

Lesson Name	Content	Context
Cooking With Numbers	Fractions, measurements, conversions	Cooking
House Transformations	Functions, geometric transformations	Interior design
Mathin' Around the House	1D, 2D, and 3D geometric calculations	Household tasks, sports
Business Bullseye	Factoring trinomials, quadratic functions	Profit modeling
Salaries, Interest, and Inflation	Central tendency, exponential growth	Household budgeting
Rolling in the Money	Estimation, modeling	Quantifying choices
Playing the Odds I	Probability	Games
Playing the Odds II	Permutations, combinations	Games
Graphing Life and Death	Line graphs, bar charts, histograms	Mortality trends
Deficiencies and Megadoses	Solving systems of inequalities	Vitamin dosages

[3]Polya's (1945) problem-solving process is a four-step approach that can be used as a guide when solving mathematical problems. The four steps are: (1) Understand the problem, (2) Devise a plan, (3) Carry out the plan, and (4) Look back.
[4]www.edmodo.com

Data Collection

The instructors' posts on the weekly online discussion board were the primary source of data. Although not every instructor posted every week, overall participation was strong with an average of 7.5 posts per week. In addition to posting individual reflections, instructors read others' posts. This was evident by instructors' direct replies to, and references about, other posts. Although only the discussion board posts were used in the formal coding, other sources of data were field notes from the one-day face-to-face workshop and the two 2-hour conference calls. As requested by instructors, researchers abstained from involvement in partner instructor observations and conferences unless invited. Findings from primary data sources were checked against available information from all data sources for consistency.

Data Analysis

Provisional coding (Miles & Huberman, 1994) uses a set of a priori codes to categorize data. Saldaña (2009) stated that it is appropriate when an applicable typology exists or when the research questions suggests a specific structure. Both situations existed in our study. Quigley's (1998) typology was used to code barriers to the successful implementation of the curriculum as situational, institutional, or dispositional. Situational barriers included physical, social, and financial issues; institutional barriers were those related to the adult learning program structure; and dispositional barriers comprised adult learner attitude, perception, and value. Similarly, quotes that described factors supporting successful implementation of the curriculum were coded as situational facilitators, institutional facilitators, and dispositional facilitators.

Our research questions informed the remaining a priori codes. Since we were interested in adult learners and instructor outcomes, we created codes for each type of outcome. We originally subdivided each into knowledge, skills, and dispositions. However, given the nature of our data and the difficulties inherent in distinguishing knowledge and skills, we combined these two into a single category. This gave us knowledge/skills and dispositions for adult learners and knowledge/skills and dispositions for instructors. Finally, it was clear that the instructors had adapted the written curriculum throughout the pilot, either out of necessity or to improve understanding among their adult learners. We coded the former situations as reactive adaptation and the latter ones as proactive adaptation. In total, this gave us 12 a priori codes. Based on Saldaña's (2009) caution to remain open to unexpected findings when using provisional coding, a 13th code was included for seemingly important quotes that did not fit into an existing code. We then used qualitative data analysis software (ATLAS.ti v. 7.0) to code the six online forum transcripts (each transcript contained all of the comments from that program's instructors throughout the pilot).

In reviewing the results of the first round of coding, we decided that additional codes were needed for mathematical content level and context. Although some quotes on these topics coincided with a priori codes, many had fallen outside of the original coding scheme. We revisited the data using two codes for content level (instructors, adult learners) and two codes for context (standardized tests, other contexts). Coded data was divided into themes, and the results presented in the following section.

RESULTS

To stay consistent with the initial research questions, results are presented based on (a) barriers and

facilitators to implementing the curriculum, (b) adaptations to the curriculum, and (c) outcomes of adult learners and instructors.

Barriers

Based on participants' posts on the online discussion board, the greatest barriers to implementing the curriculum were learner-content mismatch, lack of relevance in contexts and in content, difficulty interpreting the lesson plans, attendance patterns, and time constraints.

The most prevalent barrier was a perceived mismatch between the current mathematical ability level of the adult learners, and the level for which the curriculum was designed. Instructors from each of the six programs gave feedback about the high-level mathematical content being a barrier. Over the course of the pilot, nine instructors mentioned the difficult content level a total of 40 times.[5] However, there were differences in how the instructors handled the perceived learner-content mismatch. One program's instructors treated the mismatch as insurmountable, claiming that their adult learners could not handle that level of material. One of these instructors opted not to teach a lesson on quadratic formulas, claiming that only one of her students had ever solved quadratic formulas or factored. The other instructor skipped over a lesson on geometric transformations when she discovered "that the students could not add integers." Both of these instructors modified their lessons throughout the pilot so that the material covered was at a much lower level.

The other seven instructors were more amenable to trying the lessons despite their adult learners' current level or prior exposure to the material. These instructors all used the mismatch as an opportunity to fill in gaps for their adult learners. One such instructor, who was teaching a 13-week childcare class to learners with a wide range of math ability, wrote, "[These lessons] require a lot of prior knowledge work, but it is a good group willing to try it out!" Another instructor commented that her learners "were not level five in math and they struggled" to find the mean, median, and mode using small cubes. However, rather than giving up, this instructor provided hints and extra practice until her students were confident with the concept of central tendency. A third instructor even reported that the lower level students took great pride in learning "high math skills" and enjoyed the material because of, not in spite of, the difficulty level. Even though perceptions of adult learner capabilities varied by instructor, the different responses could not be uniformly attributed to either instructor experience or instructor age. However, there were noticeable patterns at the program level (i.e., instructors within certain programs were more proactive than others at tackling the mismatch instead of avoiding it).

Another content-related barrier was a perceived lack of relevance. Five instructors felt that some of the mathematical content in the ABE/ASE Standards at NRS EFL levels 5 and 6 was not useful to adult learners either academically (such as taking the GED®) or in their professional or personal lives. Some claims of irrelevancy originated from the adult learners while others appeared to be rooted in instructor perceptions.

Relevance was reported as a barrier not only with respect to mathematical content but also in regards to

[5]Part of this mismatch can be attributed to the composition of learners in the pilot program (see Participants section). Although the curriculum was designed with NRS EFL levels 5 and 6 in mind, many of the participating adult learners had tested into lower levels.

the contexts used in the lesson plans. One instructor described the reactions to a lesson on systems of equations based on vitamin dosages: "We worked on the Vitamin worksheets together. They found it very difficult. I kept getting the questions, 'Will this even be on the GED?', 'Why do we have to do this when it won't look like this on the GED?' So far this was their least favorite lesson." Comments such as these, echoed by learners in at least four of our pilot classrooms, underscored the importance that adult learners placed on earning their GED® as opposed to understanding the mathematical content. Using contexts that were not relevant to them on a day-to-day basis had a negative bearing on their perception of the content's relevancy.

Other barriers related to the written lesson plans rather than the specific context or mathematical content. The lesson plans had been designed to be as detailed and descriptive as possible. Despite the level of detail, five of the 12 instructors reported being confused at the intended meaning of at least one lesson plan; this confusion in many cases then passed along to their adult learners during the lesson. Four of these five instructors, plus an additional three instructors, viewed lesson plans as being overly prescriptive and impossible to get through completely in a two-hour class. These posts prompted the researchers to clarify the intent for instructors to tailor lessons to their learners as they saw fit.

The final barriers that appeared in five of the six programs involved attendance patterns and time constraints. One teacher cancelled a class because no students showed up, thereby forcing her to postpone the lesson until the students returned. While four programs had moved toward the managed enrollment model,[6] two had not. The lack of managed enrollment meant that adult learners could enter the class at any point and then attend sporadically. Interestingly, instructors from three of the four programs with managed enrollment still had attendance issues. Irregularities in attendance caused the instructors to spend more time on review than on teaching new content. Although the curriculum was designed to be completed during the 10-week pilot, none of the 12 instructors were able to do so due to time constraints. Instructors needed substantial time to teach each lesson. In order to complete the unit within the 10 weeks, most instructors chose to omit lesson plans rather than reducing time spent on topics.

Facilitators

Despite the numerous barriers, several aspects of the high-level contextualized curriculum had positive effects on adult learners and instructors. In most cases, these facilitators were strong enough to overcome the barriers listed above. Four of the six programs cited relevancy of the lessons as a facilitator to adult learning. Relevancy in this instance had two meanings. Some comments were directed toward the mathematical content; adult learners were more invested in lessons when a particular topic seemed to matter to them. "We did this lesson since multiple adult learners were taking the GED over the break and wanted to review measurements." The content of the GED® test was a major determinant of relevancy to the adult learners because all classes taught by the pilot instructors consisted of adult learners seeking their GED®; therefore, the content in their courses focused on what the test covered. "…the adult learners appreciated that the higher

[6]The managed enrollment model seeks to create a more stable class composition. Adult learners may only join the class during a fixed enrollment period, attendance is monitored, and a single course lasts for a predetermined amount of time.

level, multi-step type of questions could be on the GED® test and on employment or post-secondary entrance tests." This appreciation contrasted the statements made by instructors *and* learners, who viewed the high-level content as a barrier due to its incompatibility with the GED® test. Part of this discrepancy can be explained by the timing of the pilot program, which was held during the transition to the GED® 2014. Thus, both adult learners and instructors had wide-ranging beliefs about what would be on the new test.

Other instances of relevancy were attributed to context. Consistent with the findings of Kalchman and Koedinger (2005), instructors reported that lesson contexts that were interesting to their learners increased the motivation for learning the content. One instructor stated,

> It was such a fun lesson. The students could relate it to real life situations and truly get some hands-on experience. They had the most fun with the coupons. We actually cut coupons and came up with mock situations... revolving around name brand with coupon not on sale, name brand sale, and store brand products.

In this case, the instructor went above and beyond the lesson plan that focused on calculating percentages and multiplying by fractions and decimals, which are often a struggle for adult learners (Ginsburg et al., 2011). The context was so relevant to the adult learners that they stayed focused and active throughout the lesson.

Another lesson used card games and dice to introduce probability. Not long before the pilot was implemented the state had legalized gambling, which made the lesson particularly relevant for programs located near new casinos. In some cases, learners viewed the contexts as relevant for employability. One adult learner had applied for a job as a cook at a local restaurant, but had to admit to the interviewers that she did not know how to do conversions while cooking. This learner was particularly engaged in the lesson on measurement conversions in the kitchen, because she felt that it might help her gain employment in the future.

Program-level facilitators included class size and enrollment policy. Although nine instructors claimed that some content was too difficult, small class sizes seemed to alleviate this issue. Having fewer students gave instructors more time to help adult learners develop their skills. Another factor was whether or not programs had managed enrollment. The state's ABLE system had been encouraging programs to adopt this model, and many programs had begun to slowly transition to this model. One instructor in an ABLE program with managed enrollment described its benefits: "We have managed enrollment so adult learners who have been [in the program for some time] may not be at [NRS EFL level] 5 or 6; however, they have been moving through the curriculum with everyone else." Adult learners in this particular class were able to overcome the perceived content barrier because they had already been working on difficult content with the rest of the class.

In summary, while the main barriers to implementing a high-level math curriculum in the ABLE programs consisted of aspects of the lesson plans, attendance, and learner-content mismatch, the facilitators seemed to deal with relevancy and institutional factors. The "barrier" of high-level mathematics was best addressed with relevant content and/or contexts as well as instructor willingness to engage learners in challenging material.

Adaptations

During the first half of the pilot, adaptations

reported by instructors tended to be reactive; mostly, in response to the difficulty of the high-level mathematical content. For example, instructors omitted portions of the lessons that adult learners were struggling with, used additional explanations, or found extra resources to help adult learners understand the content in the lesson plans. Because the lesson plans were written to be at the highest two levels of the state's ABE standards, examples tended to contain fractions, decimals, or negative numbers. For learners at lower levels, the combination of difficult numbers and learning a new skill made the content overly difficult. As one instructor said, "…using decimals dilutes the problem. If you are teaching the beginning concept like I am, we needed to change the numbers to whole numbers." Another common adaptation was to reduce the amount of material covered due to time constraints.

As the pilot progressed, instructors reported more proactive adaptations. Eleven instructors reported scaffolding the content of the lesson plans with mathematical concepts from NRS EFL levels 1–4. At least half of the instructors adapted lessons by extending the context of a lesson plan or situating the mathematical concepts in a new context such as the workplace, sports, or actual problems that their students were dealing with. Nine instructors brought in outside resources for the adult learners to use. For example, one lesson plan focused on coupons and sales as a context to teach fractions, decimals, and percentages. One instructor brought in sales flyers from the newspaper and had adult learners use them to plan and price shopping lists, compare sales among stores, and decide which items would be most cost efficient. Other resources included a metrics pamphlet from the 1970s to provide historical background, toy cars for a price comparison task, candy for probability calculations, and manipulatives such as spinners, pennies, and dice.

Outcomes

All six programs reported that adult learners made recognizable gains over the course of the pilot.[7] The most-cited learner outcome, other than content mastery, was the use of Pólya's (1945) problem-solving process.[8] Eight instructors reported referring to the process beyond what the lesson plans called for, and three of these instructors even created posters to display Pólya's problem-solving steps in their classrooms. Learners in these eight classrooms began using the fourth step of checking their work more regularly during the course of the pilot. As described by one instructor,

> …[the student] was at the board working one of the problems and multiplied 5.8 times 1.115 and got 66. The other students told her that didn't make sense and should be closer to 6. The student looked at her work and found her mistake. She said that step never had crossed her mind before.

Whereas the Pólya process provided the structure for checking the reasonableness of answers, the adult learners' life experience served as the actual tool for checking solutions in context. One problem that used the Pythagorean theorem involved a ladder leaning against a wall. The learners were skeptical about the solution's feasibility, so they looked up appropriate ladder angles in a work safety manual; generally, instructors reported that learners became more analytical. On a lesson involving graphing mortality rates, one classroom "questioned the data, like what factors brought forth the increase in lung

[7]Gains were based on instructor perceptions rather than on any standardized assessment measure.
[8]Teachers were instructed on the Polya's problem-solving process and encouraged to use it in the lessons.

cancer. As a group they talked about the quality of cigarettes, environmental factors, and even an increase in women's rights."

In addition to adult learner outcomes, instructors reported changing their teaching practices. Across all programs, instructors reported spending less time lecturing and more time eliciting responses and interacting with their students. This interaction included discussion, contextual activities, and the use of manipulatives. Instructors began valuing problems "where the numbers weren't necessarily black and white, but what [the students] needed was to infer answers based off of results relating to the questions." As an example, one lesson in the Data and Probability strand called for instructors to allow learners to discover the concept of central tendency through arranging small blocks or tiles. At least four instructors felt that the manipulatives allowed learners to truly understand what all the formulas and calculations meant. One instructor mentioned how, prior to the central tendency lesson, "[my students] could regurgitate the definition and even calculate on paper but they couldn't show me with tiles because I know that they really didn't understand the concept of what finding the average really meant." The instructor claimed that, after using manipulatives, the students grasped the concept and would remember it.

Finally, instructors became more fluent in using contexts and adapting material to fit their adult learners. Financial contexts, in particular, were viewed by instructors as being helpful for learning mathematics and for developing important cost comparison and budgeting skills. Although each instructor submitted a contextualized lesson plan at the end of the pilot, discussion board comments revealed that instructors were regularly working additional context-based material into the lessons. Contexts used by the instructors in their lesson plans included measurements of concrete objects, using a map to study the coordinate plane, setting up a monthly budget, comparative shopping using discounts and coupons, and calculating loan payments.

DISCUSSION

Despite considerable interest in understanding how to help adult learners increase their math skills, there is little published research that systematically investigates mathematics curricula used in adult basic education classes (Condelli et al., 2006). This exploratory study aimed to uncover the barriers and facilitators to implementing a high-level contextualized mathematics curriculum through a pilot project with ABLE programs across the state.

The barriers that emerged from the pilot may be familiar to adult basic education practitioners and program administrators: difficult content, relevance, and attendance. Substantial resistance arose from both instructors and learners to content based on NRS EFL levels 5 and 6. Claims that this content was not relevant to learner needs—specifically, the GED®—reinforced doubts voiced by Ginsburg et al. (2011), although in a slightly different way. Ginsburg contended that the NRS EFL levels are rooted in computation-based skills that are not particularly helpful for conceptual understanding tested on the GED®. Instructors and learners in the pilot project were concerned that the content itself would not appear on the GED®. Although such concerns run contrary to a push for a broader sense of adult basic education (Schmitt, 2002; Sherman et al., 2006), instructors and learners must view the mathematical content as relevant in order to engage with it. Our findings suggest that, when learners did engage with difficult material, relevant contexts had the potential

to facilitate learning. On the other hand, contexts that were viewed as irrelevant (e.g., vitamin dosages) compounded the frustration that the adult learners were already experiencing with the material. This finding is consistent with Walkington and Sherman (2012), who observed the same patterns with high school students. As the adult basic instructors observed the connection between relevancy and learning, they were increasingly more willing to incorporate contexts that were relevant to their learners. This is an important point to note because the success of contextualized mathematics hinges upon the instructors' willingness and ability to adapt lessons to their students (Apple, 2009; Shaikh et al., 2007).

Adult learners in the pilot were engaged when the content—as well as the contexts—were relevant. Increased learner engagement facilitated student persistence in solving difficult problems exemplified by the students' application of the fourth step of the Pólya process. Additionally, instructors seemed to benefit from the increased emphasis on context and content. They adapted existing lessons, lectured less, used manipulatives in a purposeful way, and created new mathematics lessons with a contextual focus. These practices align with current recommendations on the direction that adult basic math instruction should take (Díez-Palomar et al., 2011; FitzSimons & Coben, 2009; Schmitt et al., 2009).

Implications for Practice

State-level administration and funding agencies should consider developing high-level contextualized math curricula that could be shared between programs, and adapted to concerns generated by adult learners and instructors in specific classes. This pilot study suggests that successful implementation of such curricula requires (a) encouraging a spirit of professionalism in the instructors, (b) providing training for instructors to understand high-level mathematical concepts well enough to contextualize them, and (c) encouraging instructors to adapt the curriculum whenever possible to be more relevant to their students.

Relevance should be an important consideration in lesson planning and implementation. Content that is perceived as relevant increases both adult learner and instructor motivation. Careful consideration of relevant context may help learners overcome the anxiety of approaching higher-level mathematical content and increase the likelihood that learners can integrate the math effectively into their lives. The same implications should be considered by curriculum developers and program administrators as they embark on the process of implementing high-level mathematical content in ABE programs.

Future Research

This study revealed some of the barriers and facilitators to implementing a high-level contextualized mathematics curriculum in ABE programs. Future research can build on the findings of this exploratory study to deepen our understanding of how ABE programs successfully address the barriers of difficult content, relevance, and student attendance. Additional research is needed to investigate successful implementation of curricula and professional learning that encourages instructors to adapt the curriculum in a variety of program settings (e.g., transitional ABE programs and bridge programs in community colleges), and promotes the transfer of mathematical concepts to other contexts. Professional developers should assist ABE instructors and program administrators in conducting classroom or program-based action research that can provide relevant and timely data on the effectiveness of local curricula. ❖

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Investigating Predictors of Spelling Ability for Adults with Low Literacy Skills

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ABSTRACT

This study examined whether the spelling abilities of adults with low literacy skills could be predicted by their phonological, orthographic, and morphological awareness. Sixty Adult Basic Education (ABE) students completed several literacy tasks. It was predicted that scores on phonological and orthographic tasks would explain variance in spelling scores, whereas scores on morphological tasks may not. Scores on all phonological tasks and on one orthographic task emerged as significant predictors of spelling scores. Additionally, error analyses revealed a limited influence of morphological knowledge in spelling attempts. Implications for ABE instruction are discussed.

INTRODUCTION

The 2003 National Assessment of Adult Literacy revealed that 14% of all adults in the country lack basic literacy abilities (Baer, Kutner, Sabatini & White, 2009). More recently, the Programme for the International Assessment of Adult Competencies indicated that adult literacy in the United States is significantly below average when compared to the other 21 participating nations (Organisation for Economic Co-operation and Development). This limitation not only impedes everyday functionality for these individuals, but also blocks access to better jobs, housing, and other valuable opportunities (Schwertman & Corey, 1989). Adult Basic Education (ABE) programs are addressing this troubling deficit. Studies involving ABE students' acquisition of literacy skills indicate that adult learners have different linguistic strengths than children (Dietrich & Brady, 2001; Greenberg, Ehri & Perin, 1997; Thompkins & Binder, 2003; Worthy & Viise, 1996). Adult learners also seem to have relatively sophisticated metacognitive knowledge regarding their own abilities (Viise & Austin, 2005). Thus, to make the most of an individual's time with an ABE program, it is crucial for these programs to most efficiently serve the specific learning needs of adults with low literacy skills.

Spelling is a crucial skill for adults enrolled in literacy programs, especially those seeking to improve their employment prospects. For instance, a majority of job recruiters indicated to Schramm and Dortch (1991) that even one spelling error in a resume would impede the applicant's advancement to the interview stage. Adult learners have explicitly identified spelling as a problem area (Dietrich &

Brady, 2001; Hoffman, Sheldon, Minskoff, Sautter, Steidle, & Baker, 1987). Spelling instruction, then, should logically be a major part of any ABE curriculum. However, there is a lack of statewide ABE policies for teaching spelling. When Sawyer and Joyce (2006) surveyed state directors of literacy programs in all 50 states and the District of Columbia, the 23 responding states reported that they did not have explicit policies or curricula related to spelling. This current state of ABE programs suggests that adult learners need better spelling instruction.

Knowledge Involved in Spelling

Literacy researchers have identified three key pieces of linguistic knowledge that influence spelling abilities: phonological, orthographic, and morphological awareness (Dietrich & Brady, 2001; Ehri, 1989; Greenberg et al., 1997; Frith, 1980; Henderson, 1985; Sawyer & Joyce, 2006; Worthy & Viise, 1996). Phonological awareness refers to the knowledge of relationships between letters and sounds. Past spelling research indicated that children start writing symbols resembling letters and numbers without forming recognizable words, such as spelling *tack* as *P* or *muffin* as *KO*, which is known as the *preliterate stage* (Ehri, 1989). As children begin to identify speech sounds with letters, they progress to the *semi-phonetic stage* and possibly spell *wife* as *yuf* (Ehri, 1989) and *dragon* as *gagin* (Henderson, 1985). As children advance in phonological knowledge, they enter into the *phonetic stage* of spelling, which is characterized by spellings that sound very much like the actual word when read out loud. Phonetic spellings such as *trouble* as *trubal* (Henderson, 1985) or *daily* as *dayly* (Dietrich & Brady, 2001) show children's relatively refined phonological awareness at this stage.

While letter-sound associations form the basis of the knowledge required for developing spelling skills, they do not entirely predict the spelling of an unknown word. The English language contains many irregularly spelled words, which cannot be accounted for by phonological relationships, creating the need for visual representations of common spelling conventions. Orthographic awareness refers to the knowledge of valid letter patterns in a language. Children enter the *orthographic stage* as they increase their familiarity with common English letter clusters, resulting in spelling *made* as *maed* or *pat* as *paett* (Beers, 1980).

By the time children are in the orthographic stage, they have extensive experience with reading and writing. This allows them to draw upon their growing morphological awareness, which refers to the knowledge of relationships between morphemes (Dietrich & Brady, 2001; Henderson, 1985). A morpheme is the smallest unit of meaning in a word. Morphologically complex words contain a root morpheme that has been transformed with the systematic addition of inflected endings or affixes (e.g., *care* to *careful*). Such rules can be generalized to spell unknown words in similar morphological categories. For example, if children know that the *y* at the end of some words needs to be changed to *i* in order to add the suffix *–ly*, then they would be able to successfully spell words such as *happily*, *angrily* and *steadily*. Such morphological knowledge adds a final layer of sophistication to children's spelling attempts.

These stages demonstrate that phonological, orthographic and morphological awareness are all influential in children's spelling development. Children first rely heavily on phonological skills; however, orthographic and morphological knowledge impacts spelling attempts for more advanced spellers. Research on adults with low literacy skills has not been able to establish similarly clear patterns. Studies comparing adults and children, who are matched on similar skill level, suggested that

adult learners differ from children in their use of linguistic knowledge during spelling attempts.

Differences Between Adult Learners and Children

Phonological Awareness. When compared with skill-matched children on linguistic tasks, adult learners have demonstrated weaker phonological skills (Dietrich & Brady, 2001; Greenberg et al., 1997; Thompkins & Binder, 2003). Adults scored lower than children on tasks involving phoneme segmentation, phoneme deletion, nonword reading (Greenberg et al., 1997), and a phoneme recognition task (Thompkins & Binder, 2003). Dietrich and Brady (2001) found that adult learners performed worse than skilled adults and skill-matched adolescents on a pseudoword reading task, which requires phonological abilities, and were also the least accurate and consistent in spelling words. These past studies covered wide age ranges of adults (16 to 70 years) and children (5 to 14 years); thus, these results suggested a general deficit in adult learners' phonological processing abilities. In interviews, adults with low literacy skills have traced their reading problems to interruptions or difficulties in early educational experiences (Greenberg et al., 1997). Since these academic experiences are typical among the ABE student population, it is likely that less advanced phonological awareness is a characteristic of adult learners in general.

According to studies that have conducted error analyses, less advanced phonological awareness is a limitation affecting adult learners' spelling attempts. Greenberg, Ehri and Perin (2002) examined the errors made on the spelling task involving adult learners (n=72) and children (n=72) matched at similar reading level. Based on the early stages of children's spelling development (Henderson, 1985), the researchers categorized each error as phonetic, semi-phonetic or non-phonetic. Phonetic errors could be pronounced similarly to the target word; semi-phonetic errors had many sounds in common with the target word; and non-phonetic errors did not resemble the sound pattern of the target word. Adult learners made significantly more non-phonetic errors than children, whereas children made more semi-phonetic and phonetic errors. We also analyzed errors made on the Wechsler Individual Achievement Test–Second Edition (WIAT; Wechsler, 1991) by adult learners (n=76) and children (n=119) (Talwar, Bond, Gilbert Cote & Binder, under review). Again, adults made significantly more non-phonetic errors than children, while children made more phonetic errors than adults. Worthy and Viise (1996) analyzed the spelling errors of adult learners (n=41) and skill-matched children (n=92). Adult learners struggled more with phonological mapping, making eight times as many phonetic misrepresentation errors than children. The consistency of this pattern of results, across different participant samples and spelling tasks, supports the claim that adult learners have more difficulties using phonological relationships.

Orthographic Awareness. Some of the studies also shined a light on how adult learners' orthographic awareness compared to children. Greenberg et al. (1997) found that adults performed better than children on an irregular word reading task, which involves words that cannot be successfully read using only decoding rules (e.g., *ocean*, *island*, and *busy*); thus, participants had to rely on their orthographic knowledge to read such words. Additionally, Thompkins and Binder (2003) found that adult learners were better than children at recognizing valid English letter patterns. When presented with a pair of nearly identical nonwords, adults were more successful at deciding which nonword looked

more like a real word. These results suggested that adult learners have more advanced orthographic awareness than children.

In our analyses of errors made on the WIAT (Wechsler, 1991), we found that adult learners' spelling errors had significantly higher bigram and trigram frequencies than those of children (Talwar et al., under review); bigrams and trigrams refer to groups of two and three letters, respectively. Higher frequencies suggest that the participants used more commonly occurring two- and three-letter patterns in their spelling errors. We also found that adult learners made more spelling errors that were real words compared to children, which suggested that adults' adherence to common letter patterns was sometimes extended to the entire word. Both of these analyses indicated that adult learners were better than children at observing orthographic rules. Worthy and Viise (1996) observed a similar trend in their analysis of spelling errors with invalid letter combinations, which found only 3% of adult learners' errors, as compared to 12% of children's errors. In follow-up interviews, many adults reported that they used a "looks right" approach, in which they judged their spelling attempt based on whether it looked like a real word. This technique might explain why adult learners seem to be ardent followers of orthographic rules. Other studies have indicated that successfully storing and using orthographic knowledge is a way to compensate for weak phonological skills (Greenberg et al., 2002; Siegel, Share, & Geva, 1995; Stanovich, 1980).

Morphological Awareness. Out of the three kinds of knowledge involved in spelling, adult literacy research has focused the least on morphological awareness; however, Worthy and Viise (1996) provided some insight. Adult learners in this study made 10 times as many errors as children on morphologically complex words. Although these adults usually spelled the root morpheme correctly, according to orthographic conventions, they often made errors in morphologically complex endings. They eliminated endings (e.g., spelling *pinned* as *pin*); added endings when none were needed (e.g., spelling *wrinkle* as *wrinkly*); or added incorrect endings (e.g., spelling *funny* as *funning*). Such inconsistent patterns of morphological spelling errors suggested that these adult learners were, to some degree, aware of the functions of affixes and endings, but had not necessarily mastered them. It is clear, however, that these adults were drawing upon some knowledge of morphological relationships in their spelling attempts, which warrants further investigation into the role of morphological awareness in adult learners' spelling.

Intervention studies with children showed evidence of the impact knowledge of morphological relationships has on spelling skills. In a meta-analysis of 30 interventions, Goodwin and Ahn (2013) found a moderate effect for improvements in children's spelling as a result of morphological interventions (p. 278). The impact of morphological awareness on spelling skills seems to be smaller for adult learners. Fracasso, Bangs and Binder (2014) found that after accounting for the variance explained by phonological awareness, morphological awareness uniquely explained 5% of variance in adult learners' spelling scores. These findings demonstrated that morphological knowledge may impact spelling abilities of adults with low literacy skills; however, this influence may not be as direct as other kinds of linguistic knowledge.

The Present Study

It is clear from the studies discussed so far that adults learning to read and write do not acquire and use phonological, orthographic and morphological

awareness in the same ways as children. While the contributions of these three kinds of knowledge in children's spelling acquisition have been established, there was an obvious need for similar research involving adult learners. The present study addressed this need by investigating whether adult learners' phonological, orthographic and morphological awareness can explain variance in spelling skills. ABE students completed literacy tasks that measured these kinds of knowledge, as well as spelling ability, and scores on phonological, orthographic and morphological tasks were examined as predictors of spelling scores.

Research Question and Hypotheses

Our research question was: Can phonological, orthographic and morphological awareness predict spelling scores for adult learners? Based on children's spelling acquisition, and differences between adult learners and children, we hypothesized that phonological and orthographic awareness would explain variance in spelling scores, but morphological awareness may not.

METHOD

Participants

The participants in this study were 60 students enrolled in ABE programs in western Massachusetts. These programs served a heterogeneous population of learners from diverse language backgrounds at basic, intermediate, and pre-GED literacy levels. We recruited participants from all levels. See Table 1 for participants' demographic information.

Materials

Each participant completed eleven tasks measuring spelling ability and phonological, orthographic, and morphological awareness. Participants were not under any time constraints and were allowed to skip items or ask the experimenter to repeat an item. Each correct response received a point, and skipped items were counted as incorrect. A total score was then calculated for each task.

Spelling Tasks. Two dictated spelling tasks served as measures of spelling ability. The first was the Spelling Stages Task used by Bear, Truex and Barone (1989), which contains 20 items that

Table 1—*Participants' Demographic Information*

Variable	Distribution
Gender	40 Female; 20 Male
Age	16-59 years; M=28.57; SD=10.703
Racial Identity	30% Black or African American; 13.3% White; 6.7% American Indian or Alaska Native; 6.7 Biracial/Multiracial; 5% Native Hawaiian or Other Pacific Islander; 1.7% Asian; 35% Other
Ethnic Identity	51.7% Hispanic or Latino/Latina; 23.3% African, African American or Black; 10% Multiethnic; 3.3% American; 1.7% Asian; 1.7% German; 1.7% Italian; 6.7% Other
Primary Language(s)	66.7% English; 18.3% Spanish; 3.3% Both English and Spanish; 8.3% Other
Learning Disabilities	85% No known diagnosis; 11.7% Known diagnosis; 3.3% Unsure about diagnosis

progressively increased in difficulty. The other task was an abbreviated version of the Wechsler Individual Achievement Test – Second Edition (WIAT), which has a reliability of .93 to .94, depending on the participant's age (Wechsler, 1991). We wanted to limit the task to 25 items and include items that would be challenging enough for the participants' abilities without being too demanding; thus, we used items #16 to #40 of the original WIAT. In both tasks, participants were instructed to write down the spelling of each word on a sheet provided by the experimenter. For each item, the experimenter contextualized the word in a sentence. For example, for the item *caught*, the experimenter said, "Caught. The police caught the suspect. Caught." All items were administered for each spelling task.

Phonological Tasks. The first phonological task was the Word Attack subtest of the Woodcock Reading Mastery Tests – Revised, which evaluates a participant's ability to phonetically decode nonwords and has a reliability of .87 (Woodcock, 1987). This task requires participants to read pseudowords such as *feap*, *mibgus* and *deprotenation*. There were a total of 32 items, which progressively increased in difficulty. The experimenter discontinued the task after the participant had made a total of six errors.

The second phonological task was the Phoneme Recognition Task (Bradley & Bryant, 1983) consisting of the items used by Thompkins and Binder (2003). Each item in this task consisted of a pair of real words, and participants had to judge whether the two words in each pair contained the same phoneme. This target phoneme could be present at the beginning, middle or end of the words. For example, for the pair consisting of *tropical* and *try*, the experimenter said, "Do tropical and try begin with the same sound? Tropical. Try." There were a total of 21 word pairs, all of which were administered to each participant.

The third phonological task was an adaptation of the Phoneme Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP) developed by Wagner, Torgensen and Rashotte (1999). The test-retest reliability is .81 in the adult age group. The experimenter followed the CTOPP guidelines for providing practice items and feedback. Participants were asked to say a word out loud and then repeat it after deleting the target phoneme. For example, to instruct participants to remove the phoneme /b/ from *bold*, the experimenter said, "Say *bold*. Now say *bold* without saying /b/". There were a total of 20 items. The experimenter discontinued the task after the participant made three consecutive errors.

Orthographic Tasks. Two of the orthographic tasks were the Nonword Consonant Doublet Task, and the Nonword Vowel Doublet Task (Cassar & Treiman, 1997), which have respective reliability values of .619 and .804 (Binder, Snyder, Ardoin & Morris, 2011). In these tasks, participants were presented with pairs of nonwords and asked to decide which of the two nonwords in the pair looked more like a real word. For each pair, one nonword contained a consonant or vowel doublet that could occur in English (e.g. *bb* or *ee*) and the other nonword contained a consonant doublet that could not occur in English (e.g. *jj* or *aa*). For example, when participants were shown the pairs *novv—noss* or *woor—wiir*, pointing at *noss* and *woor*, respectively, constituted correct responses. There were a total of 20 items on each task, all of which were administered to each participant.

The third orthographic task was the Irregular Word Reading Task (Adams & Huggins, 1985) that has a reliability of .968 (Binder et al., 2011). Participants were instructed to read aloud from a list of irregularly spelled words, such as *deaf* and *yacht*. There were a total of 50 items, which gradually increased in difficulty. The experimenter discontinued the task after the participant read ten

consecutive items incorrectly.

Morphological Tasks. Two of the morphological tasks were the Base Morpheme Task and the Derivational Morpheme Task, adapted from Carlisle (2000). Each of these measures have reported Cronbach alpha values of .97 for an adult low literate group (Tighe & Binder, 2014). The Base Morpheme Task required participants to produce the root of a cued morphologically complex word in the context of a sentence. For example, if the experimenter said, "Growth. She wanted her plants to [blank]," the participant had to respond with "grow". The Derivational Morpheme Task requires participants to transform a cued root word into a morphologically complex word. For example, if the experimenter said, "Teach. He was a very good [blank]," the participant had to answer with "teacher." There were 33 items in both tasks, which graduated in difficulty. The experimenter discontinued each task after six errors.

The third morphological task was the Suffix Choice Task (Berninger & Nagy, 1999). The Cronbach alpha in this population was .84 (Tighe & Binder, 2014). This task requires participants to apply morphological rules to pseudowords. The experimenter read out a sentence that had a missing word and instructed the participant to fill in the blank with one of four options. These options consisted of the same pseudoword inflected in different ways. For example, if the experimenter said, "Our teacher taught us how to [blank] long words," the participant had to choose among *jittling*, *jittled*, *jittles* and *jittle*, out of which *jittle* was the correct answer. There were 14 items in this task, which gradually increased in difficulty. The experimenter discontinued the task after a total of six errors.

PROCEDURE

These tasks were administered to participants in two sessions that took place on different days. Participants were tested in a quiet location at their program site, and received a total of $20 for their participation. All participants signed an informed consent form prior to testing and were administered the tasks in the same order.

RESULTS

Predictors of Spelling Ability

To obtain potential predictor variables, we computed combined scores for tasks measuring similar linguistic knowledge. (See Table 2 for a summary of scores on all eleven tasks and Table 3 for correlations among scores on phonological, orthographic and morphological tasks.) Since scores on the three phonological tasks were all positively correlated, they were combined to form a total phonological score (α=.539). For the orthographic tasks, scores on the Nonword Consonant Doublet Task and Nonword Vowel Doublet Task were positively correlated and were combined to form a total Doublet Tasks score (α=.647). The Irregular Word Reading scores were not correlated with the other orthographic scores; therefore, this variable was considered a separate potential predictor. For the morphological tasks, the three scores were all positively correlated and were combined to form a total morphological score (α=.770). Finally, since scores on the two spelling tasks were also positively correlated (r=.841, $p < .01$), these scores were combined to form a total spelling score (α=.902).

These total scores resulted in four possible predictor factors of spelling ability: phonological awareness score, morphological awareness score, Irregular Word Reading score, and Doublet Tasks score. Total spelling scores were positively correlated with the first three of these variables, but not with Doublet Tasks scores (Table 4). Therefore, in the

Table 2—*Participants' Scores on All Tasks*

Task	M	SD
Spelling Stages	14.62	3.58
Wechsler Individual Achievement	18.57	4.45
Word Attack	20.00	7.10
Phoneme Elision	11.92	5.13
Phoneme Recognition	17.75	2.25
Nonword Consonant Doublet	15.42	2.72
Nonword Vowel Doublet	16.52	3.01
Irregular Word Reading	38.62	7.02
Base Morpheme	24.77	8.32
Derviational Morpheme	16.05	10.04
Suffix Choice	8.08	3.67

Note: n=60

Table 3—*Correlations for Scores on Phonological, Orthographic and Morphological Tasks*

Task	1	2	3	4	5	6	7	8
1. Word Attack	—							
2. Phoneme Elision	.409**	—						
3. Phoneme Recognition	.309*	.270*	—					
4. Nonword Consonant Doublet	.116	.057	.006	—				
5. Nonword Vowel Doublet	.031	.043	.080	.480**	—			
6. Irregular Word Reading	.674**	.332*	.284*	.071	-.106	—		
7. Base Morpheme	.510**	.320*	.399**	.006	-.040	.551**	—	
8. Derivational Morpheme	.463**	.291*	.409**	.022	-.146	.553**	.657**	—
9. Suffix Choice	.604**	.477**	.399**	.224	.178	.467**	.605**	.633**

Note: n=60, ** $p < .01$, * $p < .05$

multiple regression analysis, we entered phonological awareness, morphological awareness and Irregular Word Reading score as the predictor variables. The regression analysis yielded a model that explained 51.7% of the variance, $F(3,56)=33.254$, $p < .001$. In this model, phonological awareness scores and Irregular Word Reading scores were the only unique significant predictors of spelling scores (Table 5). Since Irregular Word Reading is an orthographic skill, these results suggested that both phonological and orthographic knowledge influence adult learners' spelling ability.

Error Analyses

Since morphological awareness was positively correlated with spelling ability, but did not emerge as a significant unique predictor, further investigation of participants' morphological knowledge was warranted. In line with previous research approaches involving spelling errors (Greenberg et al., 2002; Worthy & Viise, 1997), we analyzed errors made on the Spelling Stages task, and the Wechsler Individual Achievement task, through a morphological lens.

The two spelling tasks had 15 morphologically complex items (containing more than one

morpheme) and 30 morphologically simple items (containing only one morpheme). We conducted a paired t-test to compare participants' error rates for the two item groups. Participants made more spelling errors on morphologically complex words (M=.332, SD=.217) than on morphologically simple words (M=.218, SD=.150, $p < .001$). This finding indicated that for adult learners, spelling morphologically complex words required linguistic knowledge beyond the kinds that can be used in spelling mono-morphemic words. As a follow-up analysis, we conducted an independent samples t-test comparing the Kucera-Francis word frequency values for the two item groups (Davis, 2005). Morphologically simple items had higher word frequency values (M=261.50, SD=499.65) than morphologically complex items (M=35.60, SD=34.84, $p < .05$). Another possible explanation for the higher error rate on morphologically complex items could be that these words are less frequently encountered than morphologically simple words. A clear conclusion cannot be made as to whether the difference in error rates between the two item groups was an effect of word frequency or morphological complexity.

We also examined the affixes and inflected endings in misspelled morphologically complex items. These errors were coded based on whether the affix or ending was phonetically represented, non-phonetically represented, or deleted entirely. For the item *jumped*, the misspelling *jumpt* counted as a phonetic representation, *jumpat* as a non-phonetic representation, and *jump* as a deletion. The spelling of the root word did not affect this categorization, and correctly spelled affixes or endings were counted as phonetic representations. The repeated measures ANOVA revealed significant differences, $F(1.638, 96.621)=134.849$[1]. Pairwise comparisons, using a Bonferroni correction to maintain an alpha level of .05, revealed that participants were more likely to phonetically represent affixes and endings (M=.774, SD=.034) than to represent them non-phonetically (M=.087, SD=.020, $p < .001$) or exclude them entirely (M=.123, SD=.027,

Table 4—*Correlations between Spelling Scores and Possible Predictor Variables*

Predictor	Correlation with Spelling Total
Phonological Total	.673**
Irregular Word Reading	.653**
Doublet Task Total	.087
Morphological Total	.462**

Note: n=60, ** p < .01, * p < .05

Table 5—*Regression Analysis for Spelling Scores*

Predictor	Beta	*t*
Phonological Awareness	.461**	3.642
Irregular Word Reading	.404**	3.229
Morphological Awareness	-.071	-.574

Note: n=60, ** p < .01, * p < .05

$p < .001$). However, there were no differences between the proportions of non-phonetic representations and deleted endings ($p > .05$). The prevalence of phonetically valid morphological endings in spelling errors revealed that adult learners do use their knowledge of morphological relationships to guide their spelling attempts, and that this knowledge works in concert with phonological awareness.

DISCUSSION

The purpose of this study was to examine the contributions of linguistic knowledge to the spelling ability of adults with low literacy skills. Phonological awareness and irregular word reading scores emerged as significant predictors of spelling scores, which indicated the important roles of both phonological and orthographic information in adult learners' spelling acquisition. Additionally, error analyses revealed that participants were less successful at spelling morphologically complex words as compared to morphologically simple words. While this may be an effect of word frequency, previous research has found that adult learners have more difficulty with reading morphologically complex words as compared to frequency-matched simple words (Tighe & Binder, 2013); thus, this difference suggested that more sophisticated linguistic knowledge is required to spell words with more than one morpheme. Furthermore, when participants misspelled morphologically complex words, they were likely to phonetically represent the affix or ending, instead of deleting it altogether or including a non-phonetic representation. This trend demonstrated that adult learners do attend to morphological compositions of the words they are attempting to spell, and that this morphological knowledge can build upon phonological knowledge in spelling production. Even though morphological scores did not predict spelling scores, the majority of participants accounted for affixes and inflected endings in their misspellings, which suggested that morphological awareness does seem to guide the spelling strategies of adult learners.

Phonological Awareness

The phonological system can be viewed as the foundation for higher level literacy skills. Sophisticated linguistic knowledge seems to influence children's spelling attempts only after phonological representations are mastered (Dietrich & Brady, 2001; Ehri, 1989; Henderson, 1985). Although previous research has demonstrated that adult learners' phonological abilities are weaker than those of children at the same achievement level (Dietrich & Brady, 2001; Greenberg et al., 1997, 2002; Thompkins & Binder, 2003; Worthy & Viise, 1996), adult learners do seem to rely on phonological processing while attempting to spell words. In error analysis studies, the most commonly made error type for adult learners was phonetic errors (Greenberg et al., 2002; Talwar et al., under review). Thus, while there may be differences between children and adult learners in phonological abilities, previous research was congruent with our finding that phonological knowledge influences adult learners' spelling ability.

Due to their varying educational histories, adult learners have diverse phonological skills (Greenberg et al., 1997; Thompkins & Binder, 2003). Additionally, the adults in this study were recruited from more than one ABE program, and from different class levels. This heterogeneous nature of the participant pool gives further credence to the finding: phonological knowledge emerged as a significant predictor of spelling ability. Since

[1]Since Mauchly's test indicated violations of sphericity, the Greenhouse-Geisser correction was used.

the greatest amount of variance in spelling scores was explained by phonological awareness scores, improving decoding skills should be a major part of spelling instruction in ABE programs.

Orthographic Awareness

Research in children's literacy acquisition indicated that after phonological relationships are largely mastered, orthographic knowledge begins to play an important role in spelling (Dietrich & Brady, 2001; Ehri, 1989; Henderson, 1985). English phonology was not transparent and spellers across the board must use strategies, beyond sound-to-letter mapping, to be able to successfully spell more complex English words (Beers, 1980; Treiman, 1994). Compared to children who were matched to adults on reading grade level, adults have scored higher on orthographic tasks (Greenberg et al., 1997; Thompkins & Binder, 2003) and produced more orthographically valid misspellings (Talwar et al., under review; Viise, 1996; Worthy & Viise, 1996). Consequently, it was not surprising that a certain kind of orthographic awareness – the ability to read irregular words – was a significant predictor of adult learners' spelling abilities.

Importantly, our results isolated the facet of orthographic awareness that was most relevant to adult learners' spelling. For the adult learners in this study, Irregular Word Reading score explained variance in spelling scores, whereas scores on the Doublet tasks did not. This outcome was congruent with previous findings. Readers with weak decoding abilities tended to remember atypically spelled words easier than regular words (Juel & Roper/Schneider, 1985). Adult learners clearly have phonological deficits, which was evident by the finding that their reading profiles resembled those of young dyslexics (Greenberg et al., 1997), and their poor performance compared to children on phonological tasks (Dietrich & Brady, 2001; Greenberg et al., 1997; Thompkins & Binder, 2003). Therefore, as a group, adult learners may be especially skilled at recalling unusual spellings, and may benefit from further development of this ability.

Morphological Awareness

For children, mastering morphological relationships seemed to be a crucial final step in spelling development (Dietrich & Brady, 2001; Henderson, 1985). In our study, morphological awareness was positively correlated with spelling, which showed evidence for morphological knowledge being important to adult learners as well. However, morphological awareness did not emerge as a significant predictor of adult learners' spelling abilities, which contradicts Fracasso et al.'s (2014) study that found morphological awareness explained 5% of variance in spelling scores. It was likely that the adult learners in this study were not advanced enough to have a sophisticated morphological knowledge base, which would explain why they had difficulty in spelling morphologically complex words as compared to morphologically simple words. Previous studies have shown that adult learners have deficits in the mastery of morphological rules (Rubin, Patterson & Kantor, 1991; Worthy & Viise, 1996). Even for children, morphological awareness gained importance only at the final stage of the spelling acquisition (Dietrich & Brady, 2001; Henderson, 1985). Thus, it was possible that due to their relatively weaker grasp of morphological relationships, adult learners were not able to successfully rely on morphological knowledge in their spelling attempts.

While scores on morphological tasks were not found to predict spelling scores, error analyses

revealed that morphological awareness did guide adult learners' spelling attempts. Participants in our study enjoyed relative success in accounting for affixes and inflected endings, even in misspelled morphologically complex words; they were likely to represent these morphemes phonetically. For example, participants misspelled *fortunate* as *fortunet* or *fortunit*, and strength as *strenght* or *stengt,* which are attempts to appropriately account for affixes and endings in morphologically complex words. Thus, adult learners seemed to rely on morphological knowledge to some extent in the spelling process, and a larger influence might be seen with a sample of more advanced adult literacy students.

Implications for Adult Basic Education Practices

As previously mentioned, most ABE programs do not have explicit policies or curricula related to teaching spelling (Sawyer & Joyce, 2006), but adult learners have identified spelling as an area of difficulty (Dietrich & Brady, 2001; Hoffman et al., 1987). Given that adult learners often have accurate perceptions of their learning weaknesses and needs (Viise & Austin, 2005), it is crucial that ABE programs include specific guidelines for teaching spelling. Such guidelines would make ABE spelling instruction more consistent and focused, resulting in improved spelling.

Based on the primary importance of phonological awareness in spelling for adult learners, ABE programs should focus on establishing a strong phonological foundation. ABE students can benefit from explicit lessons in phonology, including such topics as basic three-letter syllables, special kinds of word endings, vowel pairs, and multiple sounds associated with one letter (MacArthur, Alamprese, & Knight, 2010). For example, a lesson can be built around an everyday document, such as an advertisement or a letter, that features words ending in a long vowel, followed by a consonant and a final *–e* (e.g., *plane*, *note*, and *cute*). In such a lesson, teachers could include a review of previously learned phonological patterns, pronunciation and spelling principles for such words, and practice in smoothly reading such words (MacArthur et al., 2010). While children often gain basic phonological knowledge as they gradually proceed through years of school, adult learners have less time and a more crucial need for strong decoding skills.

In addition, exposure to atypically spelled words (e.g., *island, ocean*) would also be beneficial for adult learners' spelling development. The ability to read irregular words can complement decoding skills by allowing individuals to spell words that are not phonologically transparent. To make these words more accessible to students, they can be incorporated into regular lessons, such as in writing prompts or silent reading. With this measure in place, phonological and orthographic knowledge can work in concert to provide students with reliable spelling strategies.

Finally, morphology instruction may be especially helpful for higher level adult learners. Fracasso et al. (2014) indicated the need for morphological interventions in ABE programs. Such studies may involve explicit lessons in morpheme types (e.g., inflected words that change number and tense, derived words that often change part of speech and sometimes meaning, and compound words), affix meanings, and generalization rules. For example, students can be taught that sometimes when the root is a verb, the consonant on the end of the verb needs to be doubled before adding the *–ing* (e.g., *mop* to *mopping*). Similarly, sometimes the final *–e* is dropped before changing the root by adding *-ing* (e.g., *bake* to *baking*). Since adult learners have demonstrated inconsistent morpheme use in past

research (Worthy & Viise, 1996), these lessons should encourage questions and discussion, which would help rectify incorrect or incomplete morphological knowledge. Any spelling gains made in these interventions would reveal whether instruction in morphology should be included as part of spelling instruction at any ABE level.

Limitations and Future Research

Since adult learners are heterogeneous in their literacy skills, there is always the possibility that the particular sample of adult learners involved in a study may be more or less advanced in some aspect. Such differences have certainly been observed previously between ABE participant pools (Greenberg et al., 1997; Thompkins & Binder, 2003). We attempted to address this concern by recruiting students from multiple ABE programs and different levels of ABE classes. Additionally, approximately 27% of the participants did not speak English as a primary language, with Spanish speakers comprising the majority of this group. While such a distribution would be commonly found in ABE classrooms–given the varied language backgrounds of adults learners–we acknowledge that this difference in primary language might affect linguistic knowledge. When Herman, Gilbert Cote, Reilly, and Binder (2013) compared native English-speaking and native Spanish-speaking adult literacy learners, they found that the latter group had weaker morphological skills, but there was no difference in phonological skills. These results demonstrated that morphological instruction could be especially beneficial for native Spanish speakers (Herman et al., 2013). Thus, the recommendation we have made for lessons in morphology takes into account this difference in participants' language background. Therefore, our findings are likely representative of the general ABE student population.

The next step in this line of research might involve dividing learners by educational achievement level. Since ABE level designations are not necessarily consistent across programs, this categorization should be based on participants' performance on standardized dictated spelling tasks. Children's spelling development followed a stage-based trajectory, in which different kinds of linguistic knowledge was important at different levels (Dietrich & Brady, 2001; Ehri, 1989; Frith, 1980; Henderson, 1985; Sawyer & Joyce, 2006). Based on this trend, examining adult learners at different spelling skill levels can help answer two main questions: Do predictors of spelling change as spellers become more advanced? Is there evidence for spelling stages in adult learners? The findings from such studies would further inform spelling instruction in ABE programs, allowing for more appropriate lessons at different class levels.

Conclusion

The findings of this study indicate the varying roles of phonological, orthographic and morphological awareness in the spelling abilities of adult learners. The mastery of phonological relationships and the ability to read irregular words, which is an orthographic skill, were significant predictors of spelling skill. Morphological knowledge also seemed to inform spelling attempts, but this influence may be greater and more direct for advanced spellers. To see improvements in spelling scores, ABE programs should focus on building a strong foundation of phonological knowledge and increasing students' exposure to atypically spelled words. Providing explicit instruction in morphology can also positively impact spelling scores, especially for higher ABE class levels. Future research in spelling should explore differences among adult learners who have a range of spelling skills, which would have curricular implications for various ABE class levels. ❖

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PRACTITIONER PERSPECTIVE

Beyond Passive Learning: Problem-Based Learning and Concept Maps to Promote Basic and Higher-Order Thinking in Basic Skills Instruction

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ABSTRACT

Research into the best practices for basic skills education, national bridge programs, the new GED® assessment, and accelerated developmental education indicated that contextualized instruction was most effective when preparing adult literacy students for college and work. Nevertheless, "remedial pedagogy" with a sole focus on the technical aspects of basic skills, continued to dominate most basic skills instruction. Such a lack of engagement in teaching and learning may promote high attrition rates in basic skills programs. This paper recommends problem-based learning and concept mapping to promote student learning of basic and higher-order thinking skills.

INTRODUCTION AND PROBLEM STATEMENT

Across the country, adult literacy students who want to improve their lives and employment opportunities must first attend adult literacy classes. However, the slow progress and length of time it takes for adults to complete their literacy programs has

prompted a number of national efforts to mitigate the problem. Their efforts included bridge-programs that promoted contextualized learning, integrated basic skills, and occupational education within classes. These programs include I- BEST (Integrated Basic Education and Skills Training Program), RISE (Regional Industry Skills Education), and Career Pathways, which is a workforce development strategy used in the U.S. to support workers' transitions from education into and through the workforce. Early results indicated that these programs have positive results for both retention and learning outcomes among ABE, English as a Second Language (ESL) and GED® students (U.S. Department of Education, 2012).

The creators of the new General Education Development (GED®) assessment (an alternative to the high school diploma) also endorsed the use of contextualized instruction for the newly designed tests, which began in January 2014 (ProLiteracy, 2013), to assure that students who pass the tests were ready for college and/or work. Finally, Achieving the Dream has supported many pilot programs, which used contextualized instruction to accelerate the rate at which students moved through developmental education (Fong & Visher, 2013; Rotschow & Schneider, 2011).

Nevertheless, most basic skills classrooms continued to use remedial pedagogy (Grubb, 2013; Lesgold & Welsh-Ross, 2012). "Remedial pedagogy" is the use of drill and practice on small, decontextualized sub-skills (Grubb, 2013), which may be a contributing factor for the high attrition and low student success rates.

As the national bridge programs expand, and the new GED® becomes a reality, more basic skills instructors will encounter the need to include contextualized instruction among their teaching strategies. Although there is a growing literature based on contextualized instruction, most of it fails to provide specific evidenced based teaching, learning strategies, and may be too generic for use in other basic skills classrooms. Jacobson et al. (2000) noted that these generic materials created by other basic skills instructors may not be appropriate for all basic skills classrooms. Therefore, Jacobson et al. (2003) recommended that adult literacy instructors learn to design their own materials, so they are more representative of the students in their current classes. To help instructors begin the process to include contextualized instruction, reflecting their students interests and needs, this paper recommends problem-based learning and concept maps as evidenced-based opportunities to foster basic and higher-order thinking skills.

BACKGROUND AND CONCEPTUAL FRAMEWORK

Contextualized learning refers to a set of teaching and assessment practices designed to 1) provide a set of skills and knowledge that is currently relevant to the students' lives and needs, so they can actively apply them to specific real world tasks and contexts; and 2) include the idea of teaching basic skills that are embedded in the disciplinary content. Constructivist (Piaget, 1963) and social constructivist (Vygotsky, 1978) theories help to illuminate the need for contextualized learning.

Both of these theories posited that learning was an active process during which learners construct meaning by linking new ideas to their existing knowledge. Much like contextualized instruction, both highlighted the active rather than passive student role during learning. Both theories emphasized higher-order thinking skills embedded in the use of authentic tasks, settings, experiences, assessments, and presented holistically rather than in separate smaller parts (Bransford et al., 2000); possibly leading to deeper levels of learning (Weigel, 2004). Perin (2011) found that contextualized instruction

accelerated the progress of basic skills students; practitioners who used it observed positive results, and the available quantitative evidence indicated that it has the potential to increase student-learning outcomes. Jacobson et al. (2003) discovered that adult literacy students who participated in classes with contextualized activities and materials, noted an increase in literacy activity outside of class.

The current overuse of remedial pedagogy tended to produce passive students who used low-level skills (Boylan & Saxton, 2002; Boylan & Saxon, 1999) rather than the higher-level cognitive processing and thinking truly preparatory for regular college courses, and work. Based on cognitive science research and knowledge of how the brain works, "it just isn't effective to first teach skills and knowledge separated from their context, and then hope that leaners will end up knowing how to transfer what they have learned in the classroom to life outside the classroom" (EFF, 2012). Both problem-based learning and concept mapping were learning strategies that allowed basic skills students to engage in deep learning individually and in groups.

Problem-Based Learning and Concept Maps

Problem-Based Learning. The use of problem-based learning (PBL) can help increase student content knowledge (McPhail, 2011; Shore & Shore, 2004), basic skills (Shore & Shore, 2004), and higher order thinking skills (Evensen & Hmelo-Silver, 2000). PBL was well suited to help students become active learners because it situated learning in real-world problems, promoted continuous reflection and re-evaluation of prior knowledge (critical thinking), provided experience in working with ambiguous problems (problem-solving), and allowed learners to assess what they did not know (metacognition). PBL has been used to successfully integrate developmental mathematics (McPhail, 2011; Shore & Shore, 2004), and to integrate adult ESL and college-level language classes (Mathews-Aydinli, 2007).

To implement PBL, teachers should:

1. Identify the basic skills that they want the student to learn.
2. Find an appropriate problem for the students to solve including the identified basic skill. Jacobson et al. (2003) suggested the content (e.g. for the problem) for literacy instruction should reflect the students' personal, employment, and/or academic interests. These authors also suggested that the teachers design problems by first interviewing appropriate employees and academic disciplinary colleagues; then, research students so that the problems represented applicable situations that they may face in future employment, regular college classrooms, and their current lives. Torp & Sage (2002) suggested scanning local newspapers, and speaking with community members and colleagues about problems that could be used in the classroom. "We want students to own the problem and the inquiry, and to have a personal investment in the solution" (Torp & Sage, 2002, pg.18). To promote deep learning, Jonassen (1997) recommended complex and ill structured problems (multiple issues and paths to resolution) rather than simple ones (one right answer).
3. Instructors must explain the PBL process including the reasons for its use in the classroom (Mathews-Aydinli, 2007). The students then take a role in the problem. For example, if you have a problem that a carpenter would face, then they should assume the role of a carpenter. This allowed

them to take ownership of the problem.

4. Allow the groups to solve the problem. After reading and taking a role in the problem, students will presumably have more questions than the problem seems to have at first glance. The students need to become immersed in the problem, look at what information is given, and what information is not given. Students should identify what is needed to solve the problem. Then go and find the information. If this was a carpenter problem, they may need to do some mathematic calculations to determine for example the size of a piece of wood to repair an item.
5. Allow group members to help one another. During the data/information gathering stage of a PBL lesson, students should have an opportunity to share with other group members to promote critical thinking.
6. Allow for diversity in the way student groups present their solution. Then allow them to present the solution in a way that makes sense. For example, "They may choose to share their solution by using concept maps, charts, graphs, proposals, position papers, memos, maps, models, videos, or a web site. (Torp & Sage, 2002, pg. 22).
7. Assess the students with peer evaluation (groups can evaluate one another), rubrics, and student presentations. The use of traditional tests were usually inappropriate for PBL.

Concept Maps. Concept mapping (Novak, 1972) was a way to graphically organize concepts and their inter-relationships. Concept maps were very similar to mind mapping. Since it was a graphical technique, it was used more often than spoken or written language for communicating complex concepts and their non-linear inter-relationships. They may be used by teachers to communicate concepts and connections to students, assess student understanding (e.g., how well they see the big picture), study for an exam, take notes, diagram a paper or course, and document the flow of ideas. They can also enhance student learning by connecting new concepts with old familiar concepts. Individuals and/or groups can use them to demonstrate subject matter and basic skills understanding. For example, they may be used in conjunction with problem-based learning during all phases of the problem solving process. Students and teachers can either use free CMap Tools software or they can hand draw the concept maps.

According to Angelo and Cross (1993), concept maps can be used to:

- Discover preconceptions and prior knowledge a student brings to a topic by allowing them to draw a map prior to the formal introduction of lessons.
- Determine a change in understanding by employing it before, during, and after lessons
- Provide both formative (ongoing) and summative (final) feedback or assessment, and to determine how to shape the direction of lessons
- Assess a small group project
- Allow students to create an explanatory essay based on their maps

To implement the use of concept maps in the classroom the teachers can:

1. Demonstrate how to develop a concept map by creating a map of something familiar to the students. Make sure to help them understand the relationship between the concepts, the lines connecting them, and the words used to connect the concepts.
2. Show the students an overview of a partial concept map *on a familiar subject* and ask the

students to finish the map. The new GED® has partial concept maps that can be used; ask the students to complete the map.

3. Concept Maps can also be introduced by providing the concepts, and asking the class to discuss the relationships between them. Next, allow small groups or the entire class to collaboratively develop a map and negotiate how the elements should be displayed on the map. Peer feedback on maps, challenges students to critically rethink the concepts and connections on the map, to determine if they want to change the maps or if they find that the map truly represents the way they understand the material. Students were provided with multiple ways to see the same information.
4. Or, allow the students to develop their individual maps, and then they can share these maps with their peers in their small groups. For example, each student can create a map of the problem used for the problem-based learning exercise. The students within the small PBL group can compare and revise their maps when necessary.
5. Instructors can also use the maps to assess student learning through student presentations or rubrics that contain essential connections for the maps.
6. To grade the students concept maps:
   a. Develop your own map to use a guide
   b. Make sure to emphasize validity or accuracy rather than requiring students to replicate your map.
   c. Allow for creative and unexpected responses from students when grading.

CONCLUSION

The purpose of this paper was to demonstrate how to use both problem-based learning and concept maps, which allowed basic skills students to engage in deep learning individually and in groups. Several strategies were offered with specific examples of how to use problem-based learning to foster a deeper acquirement of knowledge. The teaching approach has both an individual and group component. As a result of engaging in problem-based learning, students should be able to listen to diverse perspectives and select the best one. This promotes critical thinking: a form of deep learning. Several examples for using concept maps for instruction and assessment were presented. When students created their maps, they made connections between concepts as well as including rules about basic skills. When sharing their maps, students engaged in a form of negotiation between what they thought and other perspectives, which promoted critical thinking. Both of these approaches have implications for basic skills instruction. They help the teacher become more of a facilitator and allow the students to learn content and basic skills at the same time. ❖

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RESEARCH DIGEST

How Involvement in Adult Education and Family Literacy Programs Shapes Women's Social Networks, Social Support, and Mental Health

By Dr. Cathy Kassab & Dr. Esther Prins

Proceedings of the 54th Annual
Adult Education Research Conference
2013
St. Louis: University of St. Louis-Missouri
Retrieved from http://www.adulterc.org
pp. 239-245

Reviewed by

Dr. Gary Dean & Dr. Jeff Ritchey

Indiana University of Pennsylvania

BACKGROUND

Kassab and Prins noted at the outset of this 2013 conference paper that "women with limited income and formal education are disproportionately likely to have small, less supportive social networks and to experience depression and anxiety" (p. 1). This work examined women enrolled in adult education family literacy (AEFL) programs to better understand how their involvement in these initiatives affected their social networks, social supports, and mental health.

The authors pointed out that most adult education family literacy participants were low-income women. They further noted that factors such as poverty, single parenthood, having young children, use of public assistance, and other care-taking responsibilities can be the source of stress, result in limited social support, and increase mental health issues such as depression for women participants in AEFL programs.

It was known from previous studies that women participants in AEFL programs tend to make friends, establish social support networks, and meet their psychosocial needs through their participation in the program. These can be powerful forces that shape the psychological well-being of the women. Despite these trends, little was known about how participation in AEFL impacted psychological well-being for this population.

METHODS

To better understand the dynamics and benefits of participation in AEFL, the authors developed a mix-methods study in which women participants were asked to take a number of quantitative instruments and participate in interviews. The study was conducted at five family literacy programs and two health service organizations, which included 44 participants aged 18 to 56. There were 26 White, 9 Black, 6 Latina, and 3 other women in the study. The average monthly household income for the women was $1450.00. The data were collected at three times: upon entry into the program and at two different times after the program ended. It was gathered through a variety of means including surveys, instruments, interviews, observations, and focus groups.

Little was known about how participation in AEFL impacted psychological well-being for this population.

Three research questions were addressed: 1) Does the encouragement of friendships and frequency of small group work encourage the formation of social ties among participants? 2) Do women learners engaging in higher intensity participation establish more and higher quality social ties? and 3) Do women who establish more and higher quality social ties experience improved mental health?

To shed light on these questions, a number of variables were measured through the surveys and instruments. Some of the variables measured included social interactions and social support among participants, participants and teachers, participant social networks, depression, mastery, social support, and stress. The measurement of these variables was complex. There were 24 variables that contributed to measuring social ties (nine variables contributing to degree of closeness, 11 contributing to understanding social ties with other participants, and four measuring perceived levels of social support from friends, family, and significant others). In addition, intensity of program participation was measured by the number of hours a participant engaged in program activities.

Do women who establish more and higher quality social ties experience improved mental health?

FINDINGS

There were several statistically significant findings. Overall, there was an increase in social ties among participants and between participants and teachers. Participants tended to have more friends in the program, confided in those friends more often, and had more friends that they labeled as being "very close" at the end of the program than at the beginning. They also engaged with these friends outside of the program more often at the end than at the beginning. Contrary to what might be expected, mental health showed somewhat of a decline from the beginning to the end of the program

with an increase in scores measuring depression. These results, however, were not statistically significant.

There were also a number of statistically significant findings for the first research question. The results showed that frequency of small group work, and students working in pairs were followed by increased social interaction with other students outside of the program. However, frequency of small group work did not result in increased numbers of friends or number of people known.

Overall, there was an increase in social ties among participants and between participants and teachers.

For the second research question, the authors found several statistically significant findings. Intensity of participation (number of hours of participation) was related to increased involvement in social groups outside of the program (such as church and parent-teacher associations). Intensity also was related to greater closeness with peers in the program, and having more peers with whom they could confide. This was balanced, however, with a decrease in social and family support.

Findings for the third research question were counterintuitive. The results showed that increased intensity of participation was related to increases in depression. Nevertheless, the differences between the measure of depression at the beginning and the end of the program were not statistically significant and only indicted mild increases in depression.

Contrary to what might be expected, mental health showed somewhat of a decline from the beginning to the end of the program.

DISCUSSION

The authors mentioned that the paper was a preliminary study and the results should be viewed with caution. Despite this, the study does reveal some interesting and perhaps useful trends for family literacy teachers and administrators. A major finding of the study showed that intensity of participation (number of hours of participation) was not significantly related to knowing more students, but related to increased involvement in groups outside of the family literacy program, closeness to network members, and number of student confidants. Intensity of participation was also related to decreases in social and family support from outside of the program. The implications were that while there does appear to be some benefit arising from increasing the number of hours of participation, in terms of increased closeness to other members of the program, this may be offset by decreases in family support.

Increases in mental health issues, especially depression, was surprising because increased social support is often associated with improved mental health. The authors offered the explanation that the increases in depression found in the study may be due to the fact that the participants were already

experiencing very stressful lives before participating in the program, and that stress continued unabatedly during the program. Qualitative data indicated that women experienced many stressful events in their lives including abusive partners, unsupportive family members, feelings of being overwhelmed, and difficulties with children. In addition, women, more than men, tend to acquire stress from internalizing the problems of their close friends, so this may have added to the stress the participants already felt.

This paper challenges adult basic educators to be vigilant to the complexities associated with women's participation in educational programs. This includes the potential stressors precipitated by more intensive participation as it is negotiated in already demanding social circumstances.

This paper challenges adult basic educators to be vigilant to the complexities associated with women's participation in educational programs.

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BOOK REVIEW

Reading Circles, Novels and Adult Reading Development

By Dr. Sam Duncan

New York and London: Continuum. 2012
Hardback book. 220 pages. Chapters: 11. Price: $120

"…for at least the past two hundred years, adults have formed themselves into reading circles to read and discuss novels."

Sam Duncan's *Reading Circles, Novels and Adult Reading Development* (2012), examines the use of literary reading circles as an innovative approach to adult literacy and English as a Second Language (ESL) instruction. She accomplishes her task through two objectives. Her first objective is to introduce readers to a history of literacy, reading, and reading circles, through a detailed bibliography. In the bibliographical chapters (1-5), an important point that Duncan stresses is that in ancient times, reading was mainly public, while in contemporary society it is primarily a private and silent activity. Reading circles represent a combination of both public and silent reading. Her research shows that public reading and sharing is psychologically beneficial to learners.

Duncan also discusses the various contexts and spaces where people have historically learned reading through the reading circle approach. She explains that reading circles have existed from antiquity to the present day among all classes and genders. Reading circles have been conducted by religious groups, among family members, by trade groups, workers, Victorian women, secretly by slaves, and by mutual improvement societies where groups of people meet for reading discussion and self-education. Reading circles have been conducted in a variety of settings including libraries, cigar shops, and coffee houses.

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Andres Muro

El Paso Community College

Duncan's second objective is to describe her ethnographic study on reading circles, and the pedagogical implications of the study, which she does in chapters 6-11. Her research participants consisted of a group of 10 students enrolled in adult basic education classes. Three had grown up speaking English and seven were ESL learners. The goal of the group was to read a novel and discuss it in a reading circle. The allotted time was 40 minutes a week out of a class consisting of 3 weekly hours. Her methodology is described in detail, affording readers the opportunity to understand the steps involved in conducting ethnographic work.

Her first objective is to introduce readers to a history of literacy, reading, and reading circles, through a detailed bibliography.

One of the most important pedagogical implications of reading circles is that learners are constantly engaging their peers in the process of improving academic skills. For example, in Duncan's reading circles, learners were constantly discussing vocabulary, making sense of the text, and following ideas and characters in the novel. Duncan argues that engaging peers in discussion allows participants to practice their ability to teach, crystalize and clarify thoughts. Also, it encourages practice and development of skills useful outside of the reading circle. For example, in Duncan's reading circles, students negotiated content, schedule, what to cover for each class, and expected outcomes. They negotiated their roles in the social space and their relationships to each other. They also negotiated ethical issues about characters. Learners discussed whether they agreed, disagreed, and/or empathized, with the characters, and whether they felt the characters behaved ethically. The act of negotiating roles, engaging others in discussions, agreeing and disagreeing, and questioning ethics are indispensable to daily adult life. A final salient element of the collective engagement was the enjoyment of the participants.

Duncan thoroughly describes her ethnographic approach, results and conclusions, allowing readers to gain insight in this research method.

In her conclusion, Duncan makes several remarks. I find the most important to be about the false dichotomy between the call for functional literacy and the presumed non-functional character of literary engagement. Duncan argues that the social interaction, pleasure, philosophy, ethics, emotions, culture, and metaphysical aspects of literary engagement found in reading circles are important aspects of functional citizenship and social participation.

Given the detail and depth of the text, the target audience of this book is college students, particularly upper level and graduate students, faculty, and researchers. The first five chapters of the book will also appeal to anyone interested in the history of reading and literacy.

Duncan's book accomplishes its objectives well. Her bibliographic section is very detailed. Her research is thorough, referencing the most significant authors in the field. She is also careful in using existing literature to offer support for all her themes, arguments and assertions. Duncan thoroughly describes her ethnographic approach, results and conclusions, allowing readers to gain insight in this research method. Finally, Duncan discusses pedagogical implication of her findings, which she further substantiates with her bibliography.

Given the detail and depth of the text, the target audience of this book is college students, particularly upper level and graduate students, faculty, and researchers.

As an adult educator for over 25 years, using "non-traditional", student centered instructional approaches; I have found Duncan's book to be consistent with my experiences. I strongly believe that, given the right support, students can engage literature collectively and collaborate in the process of learning. In fact, as Duncan argues, I have found that when students collaborate with each other in didactic enterprises, they learn more effectively and acquire a number of metacognitive strategies that are not always developed in more structured learning environments.

To conclude, reading circles have been used for several hundred years as a tool for literacy acquisition and development. Unfortunately, this pedagogical approach has been largely ignored by the predominant Adult Basic Education literature, which has been plagued with the more prescriptive functional literacy offerings that became popular in the early 80s, and have been further supported after the passage of the Workforce Investment Act of 1998. As such, Duncan's text represents a good resource for anyone exploring alternative and sound pedagogical approaches.

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BOOK REVIEW

Technology in Adult Basic Education: How Does Technology Impact on the Self-beliefs of Adult Basic Education Learners

By Uchenna June Nwosu

LAP LAMBERT Academic Publishing GmbH @ Co. KG, Saarbrucken, Germany. 2012
Paperback book. 212 pages. Price: $89.10

"With the rise of the use of technology in education, it is important to investigate and describe how computer technology impacts on the beliefs of capabilities that adult basic education learners hold of themselves."

Adult learners often return to their education at a later date to fulfill a missing piece in their lives. They may do so to seek employment, to change career fields, or for personal growth. Oftentimes these students have negative previous experiences with classroom learning, and these past interactions with traditionally framed education continued to affect a learner's perception of self and one's future possibilities. *Technology in Adult Basic Education: How Does Technology Impact on the Self-beliefs of Adult Basic Education Learners* investigated the connection between technology use and building positive self-esteem. Computer use can be influential in changing the self-beliefs of students through supporting the obtainment of academic and life goals.

The book was a published master's thesis, which provided original research on the use of computer technology in adult basic education. The framework was well established from the beginning, the author described her methodology in conducting research, and rationale for using her approaches. The research was both qualitative and quantitative, a mixed methods approach. Four training centers North West of Ireland provided 85 adult basic education students and three adult basic education tutors for the study. The students

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were identified as having low literacy, numeracy, and computer skills, and were engaged in classes to address these academic needs. Students were diverse in age, gender, and employment status. Two groups were included in this study, those who were not utilizing computer technology in their basic education classes, and those who were using computer technology in their studies.

Two groups were included in this study, those who were not utilizing computer technology in their basic education classes, and those who were using computer technology in their studies.

Students not using computer technology in adult basic education were surveyed to identify the level of beliefs regarding their ability to be successful in their lives and the course. Questions also measured beliefs in levels of confidence with communication skills, working with others, and using computers. More than half of the respondents reported feeling confident about achieving in the course and setting goals; they also shared wanting to believe more in themselves very often. Results identified that this group of students also desired to acquire knowledge with other learners, and would like to learn independently with the aid of a computer.

A second group of learners, who were using technology in their adult education classes, were surveyed and interviewed (both individual and group interviews). Data revealed that most students enjoyed learning with a computer, especially using the Internet for research, communication, and staying current with the news. The majority of students expressed a willingness to learn with a computer and felt enjoyment in using a computer to help them learn better. Learners also indicated increased self-confidence in their educational capabilities and in life due to learning with a computer.

The majority of students expressed a willingness to learn with a computer and felt enjoyment in using a computer to help them learn better.

Results indicated students learning with technology possessed higher self-beliefs than students who did not use computer technology in their learning. The research also uncovered that a student with a disability felt protected from discrimination when engaged in learning, and felt empowered with computer use. In addition, the study brought attention to how female students often have less confidence in using technology than male students.

Technology in Adult Basic Education can be utilized to develop understanding of the characteristics of adult basic education students, and how self-esteem affects their learning. The study clearly showed how the use of technology in the classroom can benefit the self-esteem of students, ultimately helping students become successful academically and in other areas of life. Teachers in adult basic education will gain insight in the role instructors can play in facilitating positive experiences for students in their use of computer technology.

The book encouraged me to reflect on how adult students are introduced to technology in the classroom, and the essential

role of the teacher in facilitating a positive learning experience for students in their use of computers. It helped to foster a deeper appreciation of the obstacles adult students encounter in returning to class, and explained how the use of technology can provide a safe environment for students to make mistakes and reconstruct beliefs about themselves and their ability to succeed.

The book encouraged me to reflect on how adult students are introduced to technology in the classroom.

The book clearly established the significance of positive self-esteem in helping students achieve academic and life goals. Nwosu encouraged teachers to design and present information that encouraged the development of positive self-esteem; specifically, through the use of computer technology that allows students to learn new skills with a sense of security, free from humiliation by peers. The use of technology to increase the social support systems of students via Internet and email, also, increased student self-esteem by decreasing social isolation and makes technology use personally relevant.

In adult basic education, we aspire to help students improve their lives. Students may start from the bottom and rise to greatness with support and encouragement. As Mary Kay Ash reminds us, "Don't limit yourself. Many people limit themselves to what they think they can do. You can go as far as your mind lets you. What you believe, remember, you can achieve" (Harroch, 2014). Ash was referring to her experiences in starting over and the significance of self-esteem. It applies equally well to computer technology, which can be one of the many tools teachers utilize to help students experience more success in learning; building the confidence necessary for achievement.

The use of technology to increase the social support systems... increased student self-esteem by decreasing social isolation.

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WEB SCAN

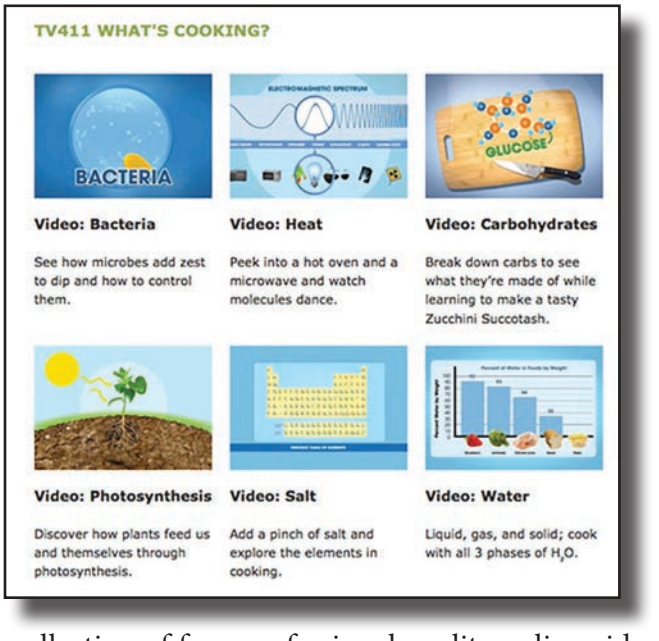
Free Online Science Videos for Adults

By Dr. David J. Rosen
President, Newsome Associates, Boston Massachusetts

Recently, I have been working with adult basic education instructors who teach science. We have been searching and reviewing science videos suitable for adult learners, and have developed a list of some of these videos and reviews. (Email me at **djrosen@newsomeassociates.com** for the list and the reviews.) For this Web Scan, here are five of the best science video web sites.

1. TV411

http://www.tv411.org/science

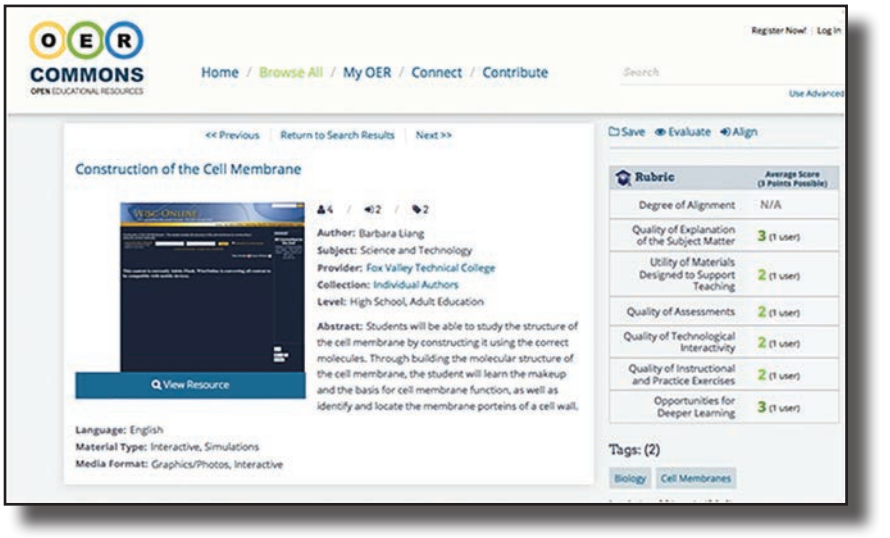


TV411 is a collection of free, professional quality online videos for adult learners. There is a section on science with the theme of cooking, which includes videos on bacteria, heat, carbohydrates, photosynthesis, salt, and water. They are highly engaging and usually accompanied by print materials. This is the only major web site with "video magazine" style videos designed for ABE learners.

By Dr. David J. Rosen

2. OER Commons

https://www.oercommons.org/courses/

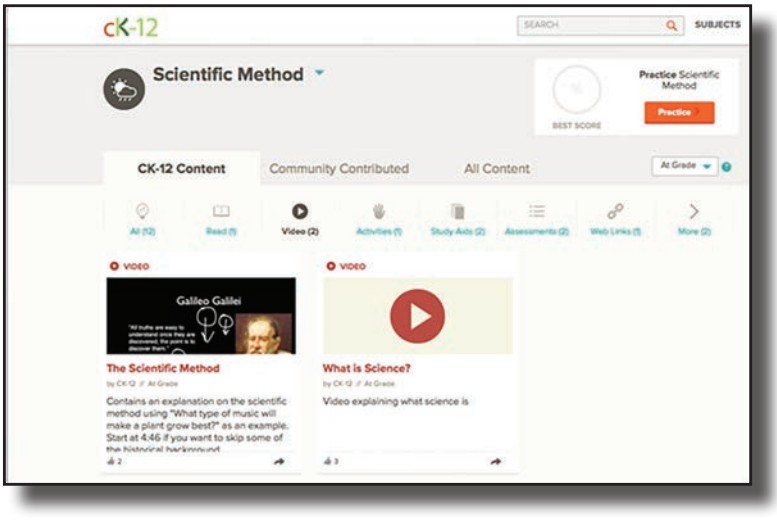


OER Commons is a huge repository of Open Education Resources. Each resource is rated by teachers using the Achieve rubrics. The science area can be searched using "adult education" and many useful resources, including a few online science videos, can be found. For example:

- 1964 Alaska Earthquake (WGBH Teachers Domain)
- Monarch Butterfly Migration (PBS Learning Media WNET)
- Botany of Desire: Monoculture (PBS Online)
- Physics: Introduction to Waves (Khan Academy)
- Health: How do cancer cells behave differently from healthy ones? (TED-Ed)
- Reactions in Chemistry (TED-Ed)
- Biology: Taxonomy and the tree of life (Khan Academy)
- Sex determination: more complicated than you thought (TED-Ed)
- How simple Ideas lead to Scientific Discoveries (TED-Ed)

3. CK12 Science

http://www.ck12.org/

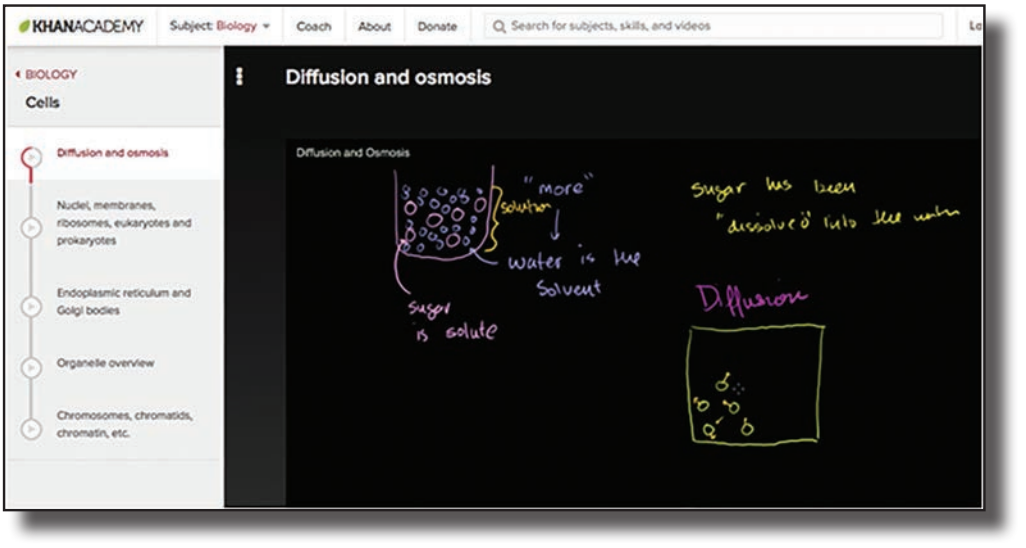


The CK-12 Foundation is a non-profit that creates and aggregates high quality curated STEM content. The web site has sections for teachers and for students. It offers videos, audio files, images, text, quizzes, and interactive learning objects in Earth Science, Life Science, Physical Science, Biology, Chemistry, and Physics.

4. Khan Academy Science Videos

https://www.khanacademy.org/#library-section

Most adult basic education teachers know that Khan Academy has free math videos. They also have science videos, some of which may be useful at the ABE level.



5. Netflix Academy

http://edexcellence.net/introducing-netflix-academy-the-best-educational-videos-available-for-streaming

Science Video categories include: Dinosaurs and other prehistoric animals, Fish and other aquatic animals, Insects, Frogs and other amphibians, Reptiles, Birds, Mammals, Human evolution, Earthquakes and volcanos, Outer space, and Systems of the human body.

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