APA Citation-Valenzuela, H. (2018). A multiple case study of college-contextualized mathematics curriculum. MathAMATYC Educator, 9(2), 49-55. Retrieved from http://www.amatyc.org/?page=MathAMATYCEducator

For a copy of this article, please email Professor Valenzuela at hrvalenz@gmail.com

A Multiple Case Study of College-Contextualized Mathematics Curriculum

Hector Valenzuela
University of Maryland University College

Contextualization is a method used for mathematics curriculum design within lesson plans and as a pedagogical practice in face-to-face classes. Many researchers are studying the effects of using contextualization in the teaching and the learning process for mathematics (Bottge & Cho, 2013; Perin, 2011; Young, Hodge, Edwards, & Leising, 2012). Contextualization refers to the teaching of mathematics problems that emphasize real-life situations. For example, an instructor could develop a contextualized assignment on exponential functions and equations by having students work on an Internet-based task to determine the monthly payment for a new car at a given price and interest rate for a specific loan duration. In this example, instructors would teach students how to compute with exponential formulas to come up with the monthly amount. Additionally, contextualization is defined as the development of mathematics problems that are authentic and related to real-world applications that are connected to students' future careers (Bottge & Cho, 2013; Bottge, Ma, Gassaway, Butler, & Toland, 2014; Valenzuela, 2012, 2014). Furthermore, students often have difficulty solving computational problems solely focused on formulaic computations, without any real-world connections (Khiat, 2010; Puri, Cornick, & Guy, 2014).

Background

Contextualization provides a foundation for researchers, instructors, and administrators to implement and study how students learn mathematics in the classroom. Researching the topic of contextualizing the curriculum is of importance to educators and researchers because of the high failure rates in both college-level and remedial-mathematics education (George, 2010; Howell, 2011). George (2010) found there to be only a 25% success rate in remedial college-mathematics education. Furthermore, Howell (2011) indicated that the high failure rates in mathematics cost four-year colleges and universities between $435 and $543 million annually. Bonham and Boylan (2011) noted that college students had to take an average of 10 credit hours of remedial college mathematics before entering college-level mathematics. On the other hand, Asera (2011) found the use of new curriculum with contextualized components and accelerated learning was another avenue for addressing the noncompletion problem in college mathematics.

Purpose

The purpose of this qualitative multiple case study was to examine the use of a contextualized curriculum within a face-to-face environment, as a way of aiding students in linking concepts, organizing mathematical ideas, and solving problems to successfully complete their college mathematics courses (Asera, 2011; Khiat, 2010; Merseth, 2011). The study addressed the challenge that college students have in linking concepts, organizing ideas, and solving problems to successfully complete their remedial and college level mathematics courses (Albritton, Gallard, & Morgan, 2010; Bonham & Boylan, 2011; Diaz, 2010). If educators fail to address this problem through new curricula such as contextualized curricula, this could increase failure rates in college math classes, which affects a student's ability to complete certificates or degree requirements for graduation (Howard & Whitaker, 2011; Sheldon & Durdella, 2010).

The researcher used a multiple case design to explore contextualized curricula. Yin (2014) indicated multiple case designs included more than two cases, and the results from a multiple case design could enhance theoretical replication between cases. Specifically, Yin noted that case study research could build upon or advance current theory. Research participants for the study were college students and instructors in remedial and college-level mathematics courses, which included a contextualized curriculum component. The researcher derived data from interviews, class observations, and curriculum documents.

Population

The multiple case study population came from three selected public colleges located in the state of Washington.

The research was conducted in the winter quarter of 2016. Although a population draws from a larger context in research, Yin (2011) argued, within qualitative research, a researcher may find it challenging to generalize from populations. Similarly, Merriam (2009) noted that generalizing from a population was not the ultimate goal of qualitative research. In contrast, by using a multiple case design, a researcher could use the results to analyze data across sites and form a stronger foundation for generalization (Yin, 2014).

The first college in the population was Lake Washington Institute of Technology in Kirkland, Washington, which has an enrollment count of 6,999 students. Lake Washington Institute of Technology offers six bachelor's degrees, 47 associate degrees, and 89 professional certificates. A majority of the students at Lake Washington Institute of Technology focus their efforts in technical and professional training to fill the current job market. The Lake Washington Institute of Technology provides small class sizes, hands-on training, and high-tech training for their students.

The second college in the population was Edmonds Community College in Lynnwood, Washington. Edmonds Community College serves 20,000 students per year and offers 61 associate degrees and 63 professional certificates. There are 29 different programs of study at Edmonds Community College. The third college site was Everett Community College in Everett, Washington. Everett Community College serves over 19,610 students per year. Everett Community College offers associate degrees, certificates of completion, and professional development. From an economic perspective, students who graduate from Everett Community College with a two-year degree earn twice as much as those students without a high school diploma.

Lake Washington Institute of Technology, Everett Community College, and Edmonds Community College provided three distinct contextualized mathematics curricula within the college population sample. The analysis of curriculum at different locations provided a diverse sampling group, which permitted the researcher to distinguish different groups and categories for the research (Benzer et al., 2013). Site permissions were obtained from the population colleges.

The specific face-to-face mathematics course at Lake Washington Institute of Technology in the multiple case study was Essentials of Intermediate Algebra. It includes a developmental college curriculum as a prerequisite for college-level mathematics. The curriculum includes applied mathematical examples and exercises in real-life topics such as finance.

At Edmonds Community College, Math in Society was the second face-to-face class included in the study. This course incorporated a curriculum that provided an overview of mathematics as applied in our current society. Math in Society is a college-level course that satisfies the degree requirements for most colleges.

The final course in the study was the face-to-face Intermediate Algebra course from Everett Community College. The instructors at Everett Community College specifically designed the Intermediate Algebra course to be taught in context to real-life examples.

Research Questions

The research questions formed the basis of the case study of contextualized curriculum through a multiple case design. The researcher derived qualitative data from structured interviews with students and faculty, direct observation of the classrooms, and curriculum artifacts. The researcher included the use of a script of questions for both students and faculty and the use of NVivo for capturing the interview, observation, and curriculum documents as data elements. NVivo is a computer application used to store, capture, organize, code, and analyze qualitative data (Bazeley & Jackson, 2013). By knowing how students construct mathematical knowledge, administrators, researchers, and educators will be in a better position to recommend and develop mathematics curriculum to assist students in completing college math requirements. Research questions for this study include the following:

1. How does the use of a contextualized curriculum help students to link concepts within a mathematics class?
2. How does the use of a contextualized curriculum help students internalize ideas within their mathematics class?
3. How does the use of a contextualized curriculum help students to solve problems successfully within a mathematics class?

Research Method

The multiple case study was descriptive in nature because the researcher described the context of how the theory of constructivism provided a basis for the success of a contextualized curriculum at the three college sites, which were the three different cases. Patton (2002) indicated that qualitative studies provided a description of individuals, real-world events, and processes. The researcher selected the three sites for analysis because of the use of contextualized college mathematics curricula in three different college settings. The researcher analyzed the three cases through instructor and student interviews, class observations, and analysis of curriculum documents.

Sample

The researcher based the sampling method in the multiple case study on a purposeful sampling methodology. Purposeful sampling, which uses specific criteria, was utilized to gather the data needed in the research study (Merriam, 2009). Specifically, the researcher used criterion sampling in the case study. Criterion sampling includes specific criteria for the sample selection (Patton, 2002). The sample criteria in the multiple case study were based on the selection of students and faculty in contextualized mathematics courses within the three population colleges.

In addition, because there were three contextualized mathematics courses in the study, the first criterion for the sample was the inclusion of the faculty teaching those courses. The second sample criterion was the selection of five student volunteers from each course. The criteria used in the selection of the five students were that the students should be from two groups: students who are engaged and interested in learning mathematics and those students who may have struggled with learning mathematics. The sample size of eighteen interviewees was the initial sample size and final sample size determined by the saturation of data in the multiple case study analysis.

Data Collection and Analysis

One of the data-gathering sources was interviews at the three colleges. The researcher was interested in how students constructed mathematical knowledge using a contextualized curriculum. In addition, the researcher preserved the interview data by recording the interviews (Holstein & Gubrium, 1995). The researcher was responsible for using the recording device in the phone interviews of students and instructors and transcribing the interviews.

A second data collection method was classroom observations. The researcher observed one class session from each of the courses in the study. For the multiple case study, to ensure objectivity, the researcher contacted the instructors before the classroom observation to obtain the class objectives and lesson plan objectives. This ensured the researcher did not draw conclusions on the observations without knowing the instructors' goals and lesson objectives. Each classroom observation lasted one hour. The researcher took field notes during the observations to document the observation sessions. According to Yin (2012), field notes were handwritten notes, which could be brief sentences or contain pictures. The researcher referenced the research questions as a foundation for the observations to understand how students construct mathematical knowledge in the classroom with the contextualized curriculum. The researcher observed the conveyance of the contextualized material to the students.

The researcher focused on collecting curriculum material from the three courses in the third method of data collection. The collected documents included examples of problem sets from each course, assessments for the students, and special project or assignment materials used in the course. Furthermore, the documents were of value to a researcher when doing case study research (Yin, 2014). The documents collected were scanned and uploaded into NVivo for coding. In addition, memo writing was incorporated into the analysis of the curriculum documents by the researcher. NVivo has a memo writing feature, which the researcher utilized for memos regarding the interviews, class observations, and curriculum documents. The researcher identified how the documents were incorporated, where they were used, and how the curriculum documents applied to the research questions.

Results

The researcher compiled demographic data on gender, age, participants by college, college mathematics classes taken, and year in college. The sample included 15 students and three instructors for a total of 18 participants. The overall demographics provided a better perspective on the students and faculty in the study. For instance, there were two males and sixteen females in the study. The majority of students were from 19 to 29 years of age. The breakdown of participants in the study included five students from Lake Washington Institute of Technology, five students from Edmonds Community College, and five students from Everett Community College, along with one faculty member from each college. Thirteen of the fifteen students had taken between one and three college mathematics courses prior to the research study. In addition, two of the three faculty in the study had ten years of college-mathematics teaching experience. The third instructor in the study had one and a half years of teaching experience. Finally, the majority of students (i.e., ten of fifteen students) were in the second year of college studies.

The researcher developed the findings from the common themes from each research question. There were twelve findings for the three research questions, and the findings are listed under the following specific research questions.

Research Question 1.
How does the use of a contextualized college math curriculum help students to link mathematical concepts within their mathematics class?

Theme 1: Engaging students by relating mathematics.
Seventeen participants (three instructors and 14 students) believed that it was important to engage students in the classroom by relating the problems to a context as a method to assist students in linking mathematical concepts. Jane, an instructor, commented, "What we do now is to actually bring out scenarios where students will explore to see how to represent the data. We've been working with cell phone plans, and the phone plans that have a certain monthly fee plus then a charge per minute." In this example, the instructor described how she incorporated the selection of cell phone plans as the basis of the real-world problem that the class worked on to engage students. The instructor's use of the cell phone plan problems helped link the concepts to topics in the class, such as understanding how the determination of the best cell phone plan was connected to solving algebraic equations and modeling of the different plans with algebra.

Theme 2: Modeling the real-world mathematics.
Six participants (all students) commented on how the mathematical modeling of real-world problems helped students in linking concepts. Jennie, explained, "And I think about my previous experience with that and that's how we apply the concepts…, anything that has to do with dimension analysis or proportions to be more particular." In this passage, the student mentioned dimension analysis and proportions as methods for modeling mathematical problems when converting units of measure. Another student, Donna, described a modeling process as, "I know that I can't have two unknowns in an equation and be able to solve for what I'm looking for usually, and this helps me model the problem." Here, Donna explained how important it was to be able to model and develop the necessary mathematical equations in a contextualized math problem.

Theme 3: Drawing real-life conclusions.
Seventeen participants (three instructors and 14 students) felt that drawing real-life conclusions about the mathematical concepts assisted them in linking concepts. Angela, a student, commented, "And, no, it has no slope, by the way [laughs] ...cause it's a flat rate." This comment was an example of how a student had a real-life conclusion based on the mathematical steps from the contextualized problem.

Theme 4: Seeing math patterns.
Twelve participants (all students) commented on seeing patterns in context, which assisted them in linking mathematical concepts. Moreover, Emily, an instructor in the current study, said,

> Because sometimes if they don't know the actual math concept they can put together a pattern. We start the quarter with patterns, finding patterns. So that they could say for a dosage of 19 milligrams I would do this, for a dosage of 100 milligrams I would need this.

In discussing how a student saw mathematical patterns and how she recognized them, Sandra, a student, commented, "Because it clicks in a sort of way, like, Oh! It's just this simple. Trying to explain things is hard, but seeing the patterns helps me understand the math."

In summary, using context for mathematics engages students, models mathematics to applications where students draw meaningful conclusions, and helps students to see patterns as they develop.

Research Question 2.
How does the use of a contextualized college math curriculum help students organize their mathematical ideas within their math course?

Theme 1: Identifying real-world math problems.
Seven participants (three instructors and four students) noted that having contextual problems to work on helped them organize the mathematical ideas. Sidney, an instructor, commented,

> We have different types of real-world problems each week. So, one week will be like bank and finance. Another week is graphs and statistics in the news. Then another week would be studying normal distribution. So, it's all different topics, but applied to the real world. So, I definitely think that those real-world applications help them tackle those problems for the specific week.

Sidney's comments reiterate how the contextualized topics provide a delineation of different categories students organize.

Theme 2: Connecting math concepts to prior concepts.
Ten participants (three instructors and seven students) believed that connecting concepts to prior concepts learned aided them in organizing mathematical ideas. Miriam, a student, said,

> Because then you learn something once, and then you get quizzed, and so you're practicing that one thing for a while before you move on to something that kind of ties in with that. But somehow, they always tie together in a way that helps me learn the concepts.

Here, Miriam states how the mathematics was connected and reinforced through the learning processes each week in her contextualized class.

Theme 3: Breaking down the problem.
Seven participants (all students) indicated that when working on contextualized problems, breaking down the problem into miniproblems assisted students in organizing the mathematical ideas. Tiffany, a student, said, "Now I can pick out what math I am seeing, pick out what relates to finance, what is related to interest rates." In this statement, Tiffany described how she separated out and developed smaller problems with the mathematics concepts in the contextualized problem.

Overall, using context for mathematics helps students organize mathematical ideas by helping them identify key elements of the problem, connect concepts to prior mathematical concepts, and break down a large problem into smaller components.

Research Question 3.
How does the use of a contextualized curriculum help students to solve problems successfully in class?

Theme 1: Facilitating the learning process.
Five participants (all students) believed that the instructor's facilitating of the learning process aided students in solving problems. Furthermore, Stephanie reiterated the importance of instructor facilitation as she said, "And so it really makes me work that left hemisphere of my brain, but I, honestly, it's the way the teacher presents it. They have to be clear." Jane, an instructor, explained the importance of facilitation when teaching contextualized problems as she commented, "I think… both the training for the contextualized learning…being able to be a facilitator versus a lecturer, but also the ongoing process of…refining that skill of being a facilitator."

Overall, the use of context aids in the process of facilitation and illustration of mathematical material to the class.

Theme 2: Having a safe place to explore and experiment.
Nine participants (all students) commented on how a safe place to explore and experiment with the contextualized problems in class aided them in solving problems. Mercedes's comments illustrate how having a safe place allowed her to experiment and practice problems in class.

> So, …I kind of step back and try to plug…maybe… do a couple of practice questions myself rather than answer the question. Based on what it is, I try to plug my own numbers in, and put my own…spin on it to see, and then nine times out of ten I'm actually able to figure it out just by throwing my own data or information in on like the questions.

Theme 3: Developing good problem-solving skills.
Eight participants (all students) noted that developing good problem-solving skills through the real-world problems assisted them in solving problems in class. Jennie further explained how she developed problem-solving and critical-thinking skills with contextualized problems She said,

> Well it, it just gets you to get more…kind of critical thinking, it gets you to start…, using your brain… other methods of how to solve it, as opposed to just calculator where I solve.…Because not every [laugh], I realize, uh, that not everything on the website, not everything looks fine on your calculator, just sometimes, you really just have to…solve it by writing things down. So, a lot of critical thinking goes, goes into it.

Theme 4: Incentive to solve the problem.
Sixteen participants (three instructors and 14 students) believed that having real-life problems provided students the incentive to successfully solve the problems. Jim, a student, discussed how important it was to have real-life problems.

> You know, part of me thinking about…simpler problems like how much is in the bank, how much do I have to pay and this sort of thing. I mean it's certainly like I say, it's kind of like math for…if I was working in the field right now, which I'm not, but I will be next quarter, it would probably be even more interesting because there's a lot of research and, and things like that that you can kind of dig into in the… counseling field.

Theme 5: Figuring out the math.

Twelve participants (three instructors and nine students) commented on how figuring out the mathematical steps and processes aided the students in solving the contextualized problems. William, a student, explained how having real-life problems helped him want to figure the problem out. He said, "It would make me want to learn the correct equation and get it down, so yes, it would make me want to solve it."

Context in mathematics helps students solve mathematical problems by facilitating their learning, providing an avenue to try different ways of solving the problem, developing good problem-solving skills, and allowing them to figure out the mathematical solution steps. Finally, the success rates in the three classes had an average success rate of 85.7%. No data was available for prior success rates.

Recommendations

Based on the findings, when instructors used a contextualized curriculum, it assisted students in the learning of mathematics. Through the use of a contextualized curriculum, students were engaged in class with real-world problems. The contextualized problems also assisted students in linking mathematical concepts in the classroom. When students made real-life conclusions based on the contextualized mathematics, students were then able to see patterns, which assisted them in further linking mathematical concepts. When students had real-life problems to work on, it assisted them in organizing their mathematical ideas. Also, the linking of concepts to prior concepts learned in contextualized problems helped students organize concepts. By breaking down the real-life situation into miniproblems, the students were better able to organize the solution steps.

Practical applications from the current study reflect pedagogical practices for faculty. Instructors should include real-world problems in their lesson plans and curriculum for both developmental (i.e., precollege math) and college-level mathematics (Elcin & Sezer, 2014). Secondly, college faculty should have an array of different teaching approaches to incorporate real-world problem solving in the classroom such as through problem-based learning and the use of projects or through the use of technology (Fatade et al., 2014; Redmond et al., 2011; Wake, 2014). Thirdly, faculty should provide a safe environment for students to experiment, compute, and try different approaches to solving problems to enhance the learning of mathematics (Deed et al., 2012; Marz & Kelchtermans, 2013). Finally, providing a process to facilitate learning for students in the classroom provides students the ability to break the problems down into miniproblems (Strimel, 2014).

Conclusions

The research provided an understanding of how students construct mathematical knowledge via a contextualized curriculum (Bottge & Cho, 2013; Perin, 2011; Showalter, Wollett, & Reynolds, 2014). The research study illustrated the effectiveness in using contextualized curriculum. The effectiveness was illustrated through the student's ability to better understand mathematical problems and solve them successfully. Students were more engaged with context around the mathematical problems, and the instructors had high success rates in mathematics classes through the use of contextualization. Further, when faculty utilized a contextualized curriculum, it assisted students in organizing mathematical ideas (Bottge et al., 2014). Moreover, the recommendations focused on pedagogical practices to assist students in learning mathematics through a contextualized curriculum, gaining an understanding of how students construct knowledge, and furthering the research on how students can learn mathematics in context-based curricula (Bottge & Cho, 2013; Doerr, Ärlebäck, & Costello Staniec, 2014; Perin, 2011).

References

Asera, R. (2011). Reflections on developmental mathematics—Building new pathways. *Journal of Developmental Education*, *34*(3), 28–31. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

Bazeley, P., & Jackson, K. (2013). *Qualitative data analysis with NVivo* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Benzer, J. K., Beehler, S., Cramer, I. E., Mohr, D. C., Charns, M. P., & Burgess, J. F., Jr. (2013). Between and within-site variation in qualitative implementation research. *Implementation Science*, *8*(1), 1–14. doi: 10.1186/1748-5908-8-4

Bonham, B. S., & Boylan, H. R. (2011). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education*, *36*(2), 14–21. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

Bottge, B. A., & Cho, S.-J. (2013). Effects of enhanced anchored instruction on skills aligned to Common Core math standards. *Learning Disabilities: A Multidisciplinary Journal*, *19*(2), 73–83. Retrieved from http://ldaamerica.org/learning-disabilities-a-multidisciplinary-journal/

Bottge, B. A., Ma, X., Gassaway, L., Butler, M., & Toland, M. D. (2014). Detecting and correcting fractions computation error patterns. *Exceptional Children*, *80*, 237–255. doi: 10.1177/001440291408000207

Deed, C., Pridham, B., Prain, V., & Graham, R. (2012). Drawn into mathematics: Applying student ideas about learning. *International Journal of Pedagogies & Learning*, *7*, 99–108. doi: 10.5172/ijpl.2012.1849

Diaz, C. R. (2010). Transitions in developmental education: An interview with Rosemary Karr. *Journal of Developmental Education*, *34*(1), 20–25. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

Doerr, H. M., Ärlebäck, J. B., & Costello Staniec, A. (2014). Design and effectiveness of modeling-based mathematics in a summer bridge program. *Journal of Engineering Education*, *103*, 92–114. doi: 10.1002/jee.20037

Elcin, M., & Sezer, B. (2014). An exploratory comparison of traditional classroom instruction and anchored instruction with secondary school students: Turkish experience. *Eurasia Journal of Mathematics, Science & Technology Education*, *10*, 523–530. doi: 10.12973/eurasia.2014.1171a

Fatade, A. O., Arigbabu, A. A., Mogari, D., & Awofala, A. O. A. (2014). Investigating senior secondary school students' beliefs about further mathematics in a problem-based learning context. *Bulgarian Journal of Science and Education Policy*, *8*, 5–46. Retrieved from http://bjsep.org/index.php

Gallard, A. J., Albritton, F., & Morgan, M. W. (2010). A comprehensive cost/benefit model: Developmental student success impact. *Journal of Developmental Education*, *34*(1), 10–25. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

George, M. (2010). Ethics and motivation in remedial mathematics education. *Community College Review*, *38*, 82–92. doi: 10.1177/0091552110373385

Holstein, J. A., & Gubrium, J. F. (1995). *The active interview*. In M. L. Miller, P. K. Manning, & J. Van Maanen (Series Eds.), *Qualitative Research Methods Series* (Vol. 37). Thousand Oaks, CA: SAGE Publications.

Howard, L., & Whitaker, M. (2011). Unsuccessful and successful mathematics learning: Developmental students' perceptions. *Journal of Developmental Education*, *35*(2), 2–16. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

Howell, J. S. (2011). What influences students' need for remediation in college? Evidence from California. *Journal of Higher Education*, *82*, 292–318. doi: 10.1353/jhe.2011.0014

Khiat, H. (2010). A grounded theory approach: Conceptions of understanding in engineering mathematics learning. *The Qualitative Report*, *15*, 1459–1488. Retrieved from http://www.nova.edu/ssss/QR/about.html

März, V., & Kelchtermans, G. (2013). Sense-making and structure in teachers' reception of educational reform. A case study on statistics in the mathematics curriculum. *Teaching and Teacher Education*, *29*, 13–24. doi: 10.1016/j.tate.2012.08.004

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation* (Rev. and exp. ed.). San Francisco, CA: Jossey-Bass.

Merseth, K. K. (2011). Update: Report on innovations in developmental mathematics—Moving mathematical graveyards. *Journal of Developmental Education*, *34*(3), 32–39. Retrieved from http://ncde.appstate.edu/publications/journal-developmental-education-jde

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Perin, D. (2011). Facilitating student learning through contextualization: A review of evidence. *Community College Review*, *39*, 268–295. doi: 10.1177/0091552111416227

Puri, K., Cornick, J., & Guy, G. M. (2014). An analysis of the impact of course elimination via contextualization in developmental mathematics. *MathAMATYC Educator*, *5*(2), 4–10. Retrieved from http://www.amatyc.org/?page=MathAMATYCEducator

Redmond, A., Thomas, J., High, K., Scott, M., Jordan, P., & Dockers, J. (2011). Enriching science and math through engineering. *School Science and Mathematics*, *111*, 399–408. doi: 10.1111/j.1949-8594.2011.00105.x

Sheldon, C. Q., & Durdella, N. R. (2009). Success rates for students taking compressed and regular length developmental courses in the community college. *Community College Journal of Research & Practice*, *34*, 39–54. doi: 10.1080/10668920903385806

Showalter, D. A., Wollett, C., & Reynolds, S. (2014). Teaching a high-level contextualized mathematics curriculum to adult basic learners. *Journal of Research and Practice for Adult Literacy, Secondary, & Basic Education*, *3*(2), 21–34.

Strimel, G. (2014). Authentic education. *Technology & Engineering Teacher*, *73*(7), 8–18. Retrieved from http://www.iteea.org/Publications/ttt.htm

Valenzuela, H. (2012). An integration of math with auto technician courses. *MathAMATYC Educator*, *3*(2), 53–56. Retrieved from http://www.amatyc.org/?page=MathAMATYCEducator

Valenzuela, H. (2014). Preparing English as a second language students for college level math. *MathAMATYC Educator*, *5*(2), 12–15. Retrieved from http://www.amatyc.org/?page=MathAMATYCEducator

Wake, G. (2014). Making sense of and with mathematics: The interface between academic mathematics and mathematics in practice. *Educational Studies in Mathematics*, *86*, 271–290. doi: 10.1007/s10649-014-9540-8

Yin, R. K. (2011). *Qualitative research from start to finish*. New York, NY: The Guilford Press.

Yin, R. K. (2012). *Applications of case study research* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage Publications.

Young, R. B., Hodge, A., Edwards, M. C., & Leising, J. (2012). Learning mathematics in high school courses beyond mathematics: Combating the need for post-secondary remediation in mathematics. *Career & Technical Education Research*, *37*, 21–33. doi: 10.5328/cter37.1.21

Hector Valenzuela (hrvalenz@gmail.com) received a BA in mathematics from the University of Texas in El Paso, an MA in mathematics from Cal State University, Fresno, and a PhD in math education from Northcentral University. Valenzuela has extensive experience teaching and researching college mathematics and statistics curriculum, and his research specialty is in college-contextualized mathematics curriculum.