

Teaching Function Mathematics Skills to Refugees

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Abstract

In the United States, after approximately 90 days of English language programs, refugee adults are placed in the mainstream, where they face enormous challenges including navigating bus schedules, buying groceries with a different monetary system, shopping for necessities, and applying for needed social services. The complexity of the mathematics that these activities require poses a significant barrier for adult refugees with limited English and interrupted education. This action research study reports on a year-long project that sought to uncover a mathematics educator's assumptions and misconceptions brought to the teaching of functional mathematics skills for small groups of refugee women. Strategies to address teaching functional mathematics to refugees are provided within each section with an emphasis on knowing the stories of students and honoring them by creating an environment of welcome and high expectations for their success.

Keywords: functional mathematics skills, misconceptions, refugees

Introduction

In a recent TED Talk, author and poet, Chimamanda Adichie tells the story of how she found her “authentic cultural voice”—and warns that if we hear only a single story about another person or culture we risk a critical misunderstanding (Adichie, 2009). Adichie's story describes the major concerns of refugees and their teachers—that of making assumptions and critiques of other cultures before teachers get to know their students' stories. The purpose of this study was to expand the stories of mathematics educators of refugees. From a year-long study of adult refugee men and women who were learning functional mathematics, this study investigated strategies that are effective and at the same time could expand the single stories that teachers may carry with them into a classroom.

The Plight of Refugees

Who are refugees and where are they from? According to the 1951 United Nations Convention Relating to the Status of Refugees a refugee is "a person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of their nationality, and is unable to or, owing to such fear, is unwilling to avail him/herself of the protection of that country" (United Nations, 1951, p. 137). Statistics on refugees are provided by the United Nations High Commissioner on Refugees (UNHCR, 2016). Syria remains a leader in numbers of displaced persons: 12 million people, or two thirds of the population is leaving. Colombia has 7.7 million refugees, then Afghanistan (4.7 million) and Iraq (4.2 million). South Sudan follows with 3.3 million with the fastest growing number of refugees. While refugees may flee to other countries, many may spend years in camps waiting to return to their own country or to another one selected by the United Nations Immigration Division (UNHCR, 2016).

The human tragedy of massive forced displacement continued to unfold around the world during the first half of 2016 with conflict, persecution, generalized violence, and violations of human rights causing forced displacement to increase further. The first half of the year saw persistent conflict in many regions, notably Nigeria, Yemen, South Sudan and the Syrian Arab Republic (Syria), leading millions to flee their homes, most remaining displaced within their own country but many also leaving for other countries (UNHCR, 2016, Introduction).

The refugee statistics are both daunting and in a constant state of flux. The United Nations Refugee Agency's annual Global Trends study found that 65.6 million people were forcibly displaced worldwide at the end of 2016 – approximately 300,000 more than in the previous year (United Nations High Commissioner for Refugees (UNHCR, 2016)). It noted that the pace at which individuals are becoming displaced remains very high. On average, 20 people were driven from their homes every minute last year, or one person every three seconds. The total number of refugees includes 40.3 million people uprooted within the borders of their own countries, about 500,000 fewer than in 2015. Meanwhile, the total number seeking asylum globally was 2.8 million, about 400,000 fewer than in the previous year. However, the total seeking safety across international borders as refugees topped 22.5 million, the highest number seen since UNHCR was founded in 1950 in the aftermath of the Second World War (Ratha, Eigen-Zucchi, & Piazz, 2016).

An examination of where refugees to the U.S. have come from and their numbers provide a glimpse into global events and the U.S.'s role in providing a safe haven (Pew Research, 2017). Of the 84,995 refugees admitted to the United States in fiscal year 2016, the largest numbers came from the Democratic Republic of Congo, Syria, Burma (Myanmar) and Iraq. Although the countries of origin have not significantly changed, in spite of shifts in policy, the end of 2017 found only 24, 559 refugees resettled in the United States.

Table 1.
Functional Mathematics Skills Delineated by NRS Levels

Functional Math Skills	NRS Learning Standard
Support Services, Cardinal Numbers, Money, Ordinal Numbers, Personal Information, Shopping, Telephone Use, Telling Time (hours), Bus Time Table	Beginning literacy
Telephone Use, Leaving a Message, 911 Calls, Before and Now, Telling Time (1/2 hour and beyond)	Low Beginning ELL
Liquid Measure Using the Newspaper to Buy Groceries	High Beginning ELL
Using the Newspaper to Study Restaurant Ads Banking	Low Intermediate ELL
Job Applications Warning Labels Getting the Facts	High Intermediate ELL
Using the Newspaper to Buy a Car, Using the Newspaper to Find an Apartment Insurance: Medical and Dental	Advanced ELL

Functional Mathematics

For the purposes of this study, functional mathematics skills are those defined by the National Reporting System for Adult Education (NRS, 2016). This is an outcome-based reporting system for the state administered, federally funded adult education program. Developed by the U.S. Department of Education's Division of Adult Education and Literacy (DAEL), the NRS continues a cooperative process through which state adult education directors and DAEL manage a reporting system that demonstrates learner outcomes for adult education. The project is conducted by the American Institute for Research (AIR).

The NRS divides educational functioning into six levels for English Language Learners (ELL). The six levels are beginning literacy, low beginning ELL, high beginning ELL, low and high intermediate ELL, and advanced ELL. The ELL levels describe speaking and listening skills and basic reading, writing,

and functional workplace skills that can be expected from a person functioning at a particular level. The skill descriptors illustrate the types of skill students at a given level are likely to have. The descriptors of functional mathematics skills do not provide a complete or comprehensive delineation of all of the skills at a given level but provide examples to guide assessment and instruction. Upon DAEL approval, states may also use additional educational levels and skill.

The contents of functional math skills are listed in Table 1. Each entry includes both the content and the NRS category. As the above list of functional skills attempts to do, it is imperative that there be ways to help refugee adults and students both to survive the trauma of the refugee experience, and to gain competence as new members of the United States. This research seeks to answer the question: What are some of the myths and misconceptions that a functional mathematics teacher brings to her work and what strategies appear to be successful given understanding gleaned from in-depth tutoring and conversations?

Methodology

Participants

The demographic variables for the 12 women in this study including age, status within the community, country of origin, and length of stay in the U.S., are found in Table 2.

Table 2.
Steps of Refugee Resettlement

1. Registration with the United Nations.	11. Third fingerprint screening. The refugee's fingerprints are screened against F.B.I. and Homeland Security databases, which contain watch list information and past immigration encounters, including if the refugee previously applied for a visa at a United States embassy. Fingerprints are also checked against those collected by the Defense Department during operations in Iraq.
2. Interview with the United Nations.	12. Case reviewed at United States immigration headquarters.
3. Refugee status granted by the United Nations.	13. Some cases referred for additional review.
4. Referral for resettlement in the United States. The United Nations decides if the person fits the definition of a refugee and whether to refer the person to the United States or to another country for resettlement. Only the most vulnerable are referred, accounting for less than 1 percent of refugees worldwide. Some people spend years waiting in refugee camps.	14. Extensive, in-person interview with Homeland Security officer.
5. Interview with State Department contractors.	15. Homeland Security approval is required
6. First background check .	16. Screening for contagious diseases.
7. Higher-level background check for some.	17. Cultural orientation class.
8. Another background check .	18. Matched with a resettlement agency .
9. First fingerprint screening ; photo taken.	19. Multi-agency security check before leaving for the United States
10. Second fingerprint screening .	20. Final security check at an American airport.

Data Sources

Data sources consisted primarily of participants' work of basic functional mathematics lessons, author's notes within a research journal and conversations with refugees, support staff, and ESL teachers. This study was conducted between January 2017 and January 2018. This period was significant because of the multiple judicial challenges of presidential executive orders made by the United States executive branch. In addition, multiple agencies within a large, Midwestern urban area with extensive networks of supporting refugees during their resettlement period provided background information on lands of the refugees' origins.

Data Analysis

As is consistent with qualitative action research, data analysis began with reading through the data multiple times and identifying initial themes. Coding procedures from grounded theory were utilized (Strauss & Corbin, 1998). The author began with open coding, a process through which data “are broken down into discrete parts, closely examined, and compared for similarities and differences” (Strauss & Corbin, 1998, p. 102). During the open coding stage, data were reviewed to understand what individuals were expressing in their responses. The second step in the coding process was to use axial coding, for the purpose of reassembling the data to develop connections and categories within the data across participants, and between student and teacher responses. This process supports research triangulation of data, a method of increasing trustworthiness in the data (Lincoln & Guba, 1985).

Findings

The findings will be presented in three sections. The first is an examination of myths identified by refugee agencies and those found by the author as she taught functional mathematics. The second and third sections describe the content knowledge and cultural themes the author found while teaching the 12 refugee women. Within a discussion of each theme, strategies for teaching functional mathematics will emerge.

Myths of Refugees

Daily images of refugees and migrants seeking safety in countries often far from their own have shocked the world. Countries and continents are confronted with tragic images of refugee-filled boats sinking. Host countries’ responses have been unpredictable; policies change nearly daily; people travel between borders and thousands die in the Mediterranean while others are saved. Given this chaos, many myths about migrants and refugees persist. By understanding these myths, teachers can better understand how students and citizens of all countries can lessen their misconceptions of policies. The following list of misconceptions and myths (Table 3) was prepared by the United Nations Regional Information Centre (UNRIC); International Organization of Migration (IOM); United Nations Development Programme (UNDP), UN Refugee Center (UNRC), United Nations High Commissioner for Refugees.

Table 3.
Myths, Facts, and Answers to Questions

Migration is bad for the economy and economies in origin countries

The proven reality is that migration brings benefits, fuelling growth, innovation and entrepreneurship in both the countries people come from, and in those they move to, if managed smartly. Migrants and refugees contribute to the economy both as employees and as entrepreneurs, creating new firms and businesses.

Stricter border controls and measures like fences reduce irregular migration

Building fences does not stop the refugee influx; it merely shifts it to other countries and increases human misery. Migrants and asylum seekers are more likely to resort to entering a country irregularly when there are no legal alternatives.

Migrants and refugees take jobs away from local people

Migrants accounted for 47% of the increase in the workforce in the United States and 70% in Europe over the past ten years according to the OECD. Migrants often take jobs that others are less willing to do or take, and can help fill gaps in the job market.

Migrants and refugees want to come to Europe and the US? Is Europe facing the world’s heaviest refugee burden?

Turkey, Pakistan, and Lebanon are now home to 30% of refugees worldwide, followed by Iran, Ethiopia, Jordan and Kenya.

Myth #1. The Resettlement Process is Straightforward

I thought everyone wanted to come to the U.S. We have many of the best advantages here. Then why are they so sad? I never believed that refugees may not want to come. It seems like a straightforward process to me. (Author 's Research Journal, Day 2)

In actuality, the migration process for refugees is initiated by the United Nations, and refugees have little input as to where their destination may be. The process of verification is not brief. It actually takes years before a person or family member may be allowed to migrate to other lands. Persons' identification documents are scrutinized. According to the U.S. State Department, 20 steps are necessary for those who wish to enter another country. These steps are included in Table 4. Because of the length of time between the initial screening and departure, officials conduct a final check before the refugee leaves for a final destination.

Table 4.
Steps of Refugee Resettlement

1. Registration with the United Nations.	11. Third fingerprint screening. The refugee's fingerprints are screened against F.B.I. and Homeland Security databases, which contain watch list information and past immigration encounters, including if the refugee previously applied for a visa at a United States embassy. Fingerprints are also checked against those collected by the Defense Department during operations in Iraq.
2. Interview with the United Nations.	12. Case reviewed at United States immigration headquarters.
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5. Interview with State Department contractors.	15. Homeland Security approval is required
6. First background check .	16. Screening for contagious diseases.
7. Higher-level background check for some.	17. Cultural orientation class.
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Although the refugee women in this study never shared which countries they would have liked to have been resettled in, they unanimously wanted to go "home." Statistics are essential to see a larger picture and to support advocacy efforts for refugees, yet the women's stories built a "bridge of empathy" (Fleming, 2017) that helped people to understand why refugees take the risks to come to this country.

The following strategies were developed by Canadian teachers as they met students who had experienced trauma during their lengthy resettlement (Calgary Board of Education).

- Build safety through routines. Create predictable environments and responses. Use routines to assist students to know what will happen next and why they are asked to do something.
- Establish regular activities, with consistent greetings and good-byes, daily reviews, transition point markers, calming activities, etc.
- Choose important routine events to celebrate (e.g., birthdays, holidays)
- Recognize and avoid triggers that may remind refugees of traumatic past events.

Myth #2: If One Knows Social Language Then One Knows Academic Language

“What do you mean, ‘quarter past two’ when you said a quarter was 25 cents.” (Refugee adult after being asked to show 2:15 on an analog clock)

The author assumed that if an individual could communicate socially, academic language would be an automatic by-product and easily assimilated. But it became evident that not only do English Language Learners have difficulty in acquiring academic language skills, but teachers from various disciplines (mathematics education included) have difficulty preparing students for academic and professional achieved with academic language. Functional mathematics skills require academic language abilities. The vocabulary of measurement alone can be daunting given that all refugees are from countries that use the metric system.

Cummins (1984, 1991, 1994, 2000) explained that Basic Interpersonal Communicative Skills (BICS) and Cognitive/Academic Language Proficiency (CALP) are qualitatively different skills. BICS include skills such as pronunciation, basic vocabulary, and grammar required in everyday communication situations. Most immigrant students can develop these skills rapidly, with the result that "teachers prematurely assume that minority children have attained sufficient English proficiency to exit to an English-only program" (p. 27). In addition, Cummins criticized policymakers' demands for a quick transition to English-only instruction by stating that the policies are “veneers for the xenophobic belief that minority languages threaten social cohesion” (p. 27). In contrast to BICS, which involve contextual processing of language, CALP is a cognitively demanding process that is not embedded in a meaningful interpersonal context. Cummins (1981, 1992) reviewed numerous research studies that point to the interdependence of native and second language learning in advancing CALP skills and indicated that second language CALP takes five years or more to develop.

Strategies for teaching BICS and CALP are to enable the learner to communicate in simple language and to understand the meaning of what is heard. Asking questions and answering them takes much practice in functional mathematics skills. Collaborative learning cultures, role-playing, interviews and games make the language-building activities of BICS and CALP helpful in writing, reading, speaking, and listening, and creating a sense of community as well. Discussing current events has the whole classroom involved in conversations informally.

Myth #3: Math is a Universal Language

“This is the way we do maths in my country.” (Students were adding $\$.34 + \$.45$. One woman wrote tally marks to show tenths, and hundredths. while completing a page of addition and subtraction problems.) If I did not know mathematics as well as I do, I would never consider their solutions and processes as correct. It took two and three reviews of their work to determine that they were correct. It was not incorrect, it was just different. (Authors' Research Journal).

Although some mathematical calculations and processes may be similar, once students begin to solve word problems or more complex problems, they encounter difficulties in academic language. Mathematical language presents them with words and symbols that have double meanings, like “table,” and English expressions, such as questions asking for the “difference” between two numbers. Instead of an answer to a subtraction problem, some may respond by stating similarities and differences in numbers. The level of complexity and high degree of emphasis on academic language makes it more difficult to grasp thus needing more support.

Steinhardt NYU researchers have identified additional difficulties and confusions often faced by English Language Learners (ELLs and Mathematics, 2009). These include:

- Students must learn to associate mathematical symbols with concepts and the language used to express those concepts. Example: the symbol / expresses the idea of something ‘divided by’.
- Mathematical texts frequently use the passive voice, a complex and difficult structure for many non-English speakers. For example: ten (is) divided by two and when 15 is added to a number, the result is 21; find the number.

- Mathematics also uses strings of words to create complex phrases with specific meanings, such as a measure of central tendency and square root.

Even if mathematical language can be considered universal, the language of ‘doing mathematics within the classroom’ is far from universal. The language of exploratory discussions, the discourse-specific mathematical talk, and the mathematical talk and writing taking place in the language of instruction, make it unique to each culture (Planas, 2001). Whether an English language learner or a native speaker, each one faces a challenge in learning to converse within the mathematics language. Moschkovich writes, “The communicative competence necessary and sufficient for competent participation in mathematical discourse practices... [involves] specialized vocabulary, syntax, organization, register and discourse practices” (Moschkovich, 2012, p. 22). Moschkovich suggests that the presence of ELL learners in the classroom can help build an awareness of the linguistic challenges we face as classroom teachers. Thus, instead of considering ELL as problematic, she considers English learners as a gift, because when one hears imperfect language with an accent, or has incorrect tense, students and teachers are reminded that even if you are in a monolingual English class, with students who are native English speakers, there are language issues going on there as well (Moschkovich, 2012).

Content and Cultural Themes

In addition to encountering myths and misconceptions while teaching mathematics to refugees, the author found content and cultural themes that when examined, could provide greater insight for those who teach functional mathematics. Discussions within each theme will also describe strategies and research that may support adult learners.

Content Theme 1: A Picture Is Worth a Thousand Words, But An Object and Gestures Are Worth More.

“I like it when I can see what you are talking about.”

“I can’t understand the money without real money. I can’t see the numbers”

“I liked it when you brought in a pizza and we found $\frac{1}{2}$ and $\frac{1}{4}$ of the pizza, then you cut out papers and you showed us $\frac{1}{2}$, $\frac{1}{4}$.” (Student after three sessions on money and common fractions)

To develop vocabulary, the refugee women appreciated multiple representations in functional math. The Universal Design for Learning (UDL) framework emphasizes multiple means of representation, multiple means of expression, and multiple means of engagement (Rappolt-Schlichtmann, Daley, & Rose, 2012). UDL provides educators with a framework for all kinds of learners in mind. ELLs, while limited in their English proficiency, come to school with variability in their home language skills, from full oral and literate proficiency, to very limited skill sets (Meyer, Rose, & Gordon, 2014). In using UDL, the author was able to guide the development of measurement terminology and basic cooking by using pictures, utensils, recipes, bus schedules, and newspaper advertisements.

Content Theme 2: Awareness of Sources of Confusion: Multiple Meanings of Words

You said a quarter past five, but a quarter was 25 cents. Why isn’t it 25 minutes after five? (Adult Refugee)

Adult learners in this study consistently were confused over the meaning of mathematics vocabulary. For example, the meaning of ‘quarter’ was difficult because of its dual meaning. Polysemous words, which are words with the same spelling and pronunciation but different meanings, can be confusing for adults to understand. Many words are used in math textbooks and teaching which differ from their everyday life meanings. Instruction in specific vocabulary is crucial because vocabulary knowledge correlates with math reading comprehension (Smith, 1997; Sidek, Rahim, 2015). Students also found that words functioning as a verb, a noun, or an adjective also have different definitions.

As refugees advance in their language skills, strategies to become competent in examining the context to decide whether the meaning of the conversion is closely related to the meaning they already know are essential. The author found that her role was not only to teach children about this language phenomenon, but also to help the women develop confidence in their ability to infer the meaning of a conversion. This requires us to help readers attend closely to context. It also means helping students identify the grammatical function of a word, which can be difficult for beginning English speakers and writers.

In one relevant study, Carlo et al. (2004) taught fifth graders about how English words work. Topics included learning about polysemy, learning the structure of morphologically complex words and understanding the nature of academic language. On the polysemy post-test, the ELL group made significant improvement compared to their pre-test scores, yet despite this gain they did not match the progress of students who spoke English natively. However, both groups -- ELLs and native English speakers -- made significant gains over the control group, who did not receive the intervention. Within the current study, students appeared to enjoy the experience!

Content Theme 3: Repetition, Repetition, Repetition...

“1 O’Clock, 2 O’Clock, 3 O’Clock...” Rote repetition of time. I think they got the sound and meaning of hours.” (Authors’ Research Journal—Week 6)

“Oh no, they did not remember the times on the clock nor did they get what the numbers around the clock represented.” (Authors Research Journal, Week 7)

Among the language learners in the study, repetition was essential. But the author soon discovered the importance of “deliberate practice.” Deliberate practice is not the same as rote repetition. Rote repetition—simply repeating a task—will not by itself improve performance. This is what I found after one week with the adult learners. When using deliberate practice, which involved attention, rehearsal and repetition leading to new knowledge or skills, I was able to make the concepts understood. (Hambrick, et. al., 2014). Although other factors are necessary, deliberate practice with meaning appeared to be helpful in learning.

Cultural Theme 1: Understanding Background

“Why are some of the adults so sad? I asked for information from social workers and staff. They mentioned that many of the refugees are reminded of traumatic experiences. It seems that functional mathematics does not seem to be important to them. I need to pursue their background knowledge.” (Author Journal Entry 26)

Upon returning from sessions of functional mathematics skills, I searched for available information on the refugees’ backgrounds and their educational backgrounds. Linking to students’ personal life experiences is beneficial for a number of reasons. Personal life experiences can help students find meaning in content learning, and linking to an experience can provide clarity and promote retention of learning. Relating content to students’ personal lives and experiences also serves the purpose of validating students’ lives, culture and experiences.

For example, Haynes & Zacarian (2010) note that in general, members of the dominant U.S. culture believe that children should be raised to think independently. The goal of education is to have children learn to think like adults when they are still children. Children's efforts to think and use their independent thinking skills are praised and rewarded. Their wants, needs, and desires are often viewed as of primary concern in the family.

However, many refugees come from collectivistic cultures in which the good of the individual is sacrificed to the good of the group. A person's moral worth is judged by how much he or she sacrifices for the group. Students from this type of culture work best when they can form a relationship with the group. They are “we” rather than “I” oriented. Because of their subtle influence, these factors are important for all teachers and administrators to know (Zwiers, et.al, 2017).

Cultural Theme 3: Parents Desire to Succeed

When adult students introduced themselves, and spoke of their children, they often said that their children were helping them learn at home. Their children often help the parents. (Author Research Journal).

It became clear that the adults in the study were eager to learn since they wanted to help their children with homework. Many children of these refugee women supported their parents in language development. This role reversal can be a source of culture shock. Because of different cultural beliefs, many parents may understand the concept of parental involvement differently from the way that U.S. parents do. These conditions may increase cultural dissonance.

Children may be encouraged to practice language skills by teaching their parents. The exchange of ideas and information encourages communication skills in listening, speaking, writing, and reading. When students become the “teacher” to family members, they are participating in a process termed “language brokering” (Tse, 1996). Language brokering refers to translation between linguistically and culturally different parties. Language brokers are often the children of immigrant and refugee families who serve as interpreters and translators for their parents and family members (Morales & Hanson, 2005; Tse, 1996). These children may accompany their parents to a doctor’s appointment to interpret conversations, help translate the content of a letter sent home in English, or speak on the phone (on behalf of a relative) to school personnel. Language brokers rarely receive formal training as translators or interpreters, yet their day-to-day experiences often draw on their bilingualism. In this study, the author encouraged parents to bring their children to class to demonstrate to children how their parents are learning and the importance of respecting each other’s ability to communicate.

Conclusion

As Chimamanda Adichie summarizes in her TED Talk,

Stories matter. Many stories matter. Stories have been used to dispossess and to malign, but stories can also be used to empower and to humanize. Stories can break the dignity of a people, but stories can also repair that broken dignity.

This action research study points to the importance of teachers' and administrators' understanding of the refugee experience and the dangers of assuming a single story. Misunderstanding the dire situations of parents, the role of trauma in refugees' behaviors, cultural differences, and best practices in language acquisition can hinder the teaching and learning processes. (Birman et al., 2001; Timm, 1994; Trueba et al., 1990). Although the list of strategies presented in this paper may be incomplete, this research strongly recommends the importance of knowing the stories of students and honoring them by creating an environment of welcome and high expectations for their success.

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