Mathematics and Intercultural Competence in the Middle School
Christopher Bennett, Megan Brunner, and Kyle Evans

UConn REU 2015   Advisor: Dr. Fabiana Cardetti

Overview

Motivation:

As today's world becomes increasingly globalized, schools have implemented curricula, units, and lessons that incorporate global citizenship and intercultural competence (ICC). Our goal is to create assessment tools that measure the development of these principles in children, specifically in sixth grade, as the Farmington (CT) School District plans to implement three interdisciplinary units designed to develop ICC. In addition, we aim to create lessons across all grade levels that incorporate ICC while focusing solely on mathematics.

Key Definition:

Intercultural Competence: a person's ability to relate to and communicate with people who speak a different language and live in a different cultural context (Byram, 1997)

Theoretical Framework:

We primarily based our assessment tools on the works of Michael Byram. In his work, Byram defines five factors of ICC: attitudes, knowledge, skills of interpreting and relating, skills of discovery and interaction, and critical cultural awareness (1997). In our assessments, we focus on the factors of attitudes and knowledge as they are more susceptible to development in our sixth grade audience (2008).

Research Questions:

1. How can intercultural competence be appropriately assessed within a middle school environment (with a specific focus on sixth grade students)?
2. How can intercultural competence be incorporated into K-12 mathematics classrooms?

Survey

Purpose:

The purpose of the survey is to provide data for analysis of the effectiveness of the interdisciplinary units with regards to how well they promote students' attitude towards and understanding of other cultures, how well different subjects relate with teaching material and building off of lessons of other classes, and how well the units promote understanding of mathematics.

Methods:

After reading Byram's works and investigating other surveys, we independently composed a list of potential items. We initially compiled between 80 and 90 items which we then separated into four primary dimensions based on the ideas of Byram and our task: attitudes, knowledge, mathematical learning, and interdisciplinary learning. After categorizing items, we refined our list by removing items with similar meaning and items with complex language. We received assistance from experts in psychometrics and intercultural competence as well as 17 research assistants in editing our items.

Results:

Our final survey, the Mathematical and Intercultural Awareness Survey (MICAS), consists of five demographic questions, 33 Likert scale items in four dimensions each on a 5-point scale, and five open-ended questions.

Sample Survey Items

A	I can understand my own culture without knowing about other cultures.
K	I feel that I can clearly explain my culture to a pen pal in another country.
M	I do not need math to understand another culture.
I	I enjoy learning about the same topic in different subjects.
O	What are three things you learned about other cultures in math class?

A: attitudes; K: knowledge; M: mathematics learning; I: interdisciplinary learning; O: open-ended questions

References

Byram, M. (1997). *Teaching and assessing intercultural communicative competence*. Clevedon, United Kingdom: Multilingual Matters.

Byram, M. (2008). *From foreign language education to education for intercultural citizenship: Essays and reflections*. Clevedon, United Kingdom: Languages for Intercultural Communication and Education.

Rubric

Purpose:

The purpose of the rubric is to provide a resource for teachers to evaluate observable student behaviors as well as written responses for the development of intercultural competence (ICC).

Methods:

Through our research we found several examples of rubrics that assess ICC in undergraduates. As a result, many of the high levels of these rubrics were not applicable to our target audience. We adapted categories from existing rubrics, adjusted observable behaviors to a sixth grade level, and consulted an expert in educational psychology to refine the rubric. To ensure accurate assessment, we created a teacher's guide to explain uses of the rubric.

Results:

The final rubric consists of 4 levels of development (insufficient, developing, emerging, proficient) for each of 4 categories (Curiosity, Openness, Knowledge of Self, and Knowledge of Others).

	4 "Proficient"		1 "Insufficient"
Curiosity	Student shows interest in learning about all aspects of different cultures and subcultures. Student asks questions which are able to form discussions among peers.	⋯	Student lacks interest in learning about cultures. Student asks few or inappropriate questions during class time.
Knowledge of Self	Student shows an understanding of relationships between cultural products, symbols, and practices of their own culture. Student is aware of stereotypes about their own culture and subcultures and attempts to correct these biases.	⋯	Student shows little to no knowledge of their own cultural products, symbols, and practices. Student is unaware, or even promotes, stereotypes about their own culture and subcultures.

Table 1: Two Categories of the Rubric

Goals and Future Research

These assessment tools are planned to be used with the Farmington School District along with the interdisciplinary units, and will continue to be refined after collecting and analyzing data. While designed for sixth grade, our tools serve as a new baseline for middle grade levels. We hope that these tools will be adapted for use in other schools and grade levels in order to promote the incorporation of ICC into classrooms.

Lesson Plans

Purpose:

Our overarching goal was to create mathematics lessons plans that meaningfully incorporate the development of intercultural competence as well as meeting the Common Core State Standards for Mathematics. We decided to create lessons for 3rd grade, 6th grade, and 9th grade to provide an example for three different levels of cognitive development.

Grade 3:

In this lesson, students will work with the concepts of area and perimeter while being exposed to major agricultural products of different countries. A packet of word problems will be used in which students answer questions relating themselves to a farmer growing a particular crop.
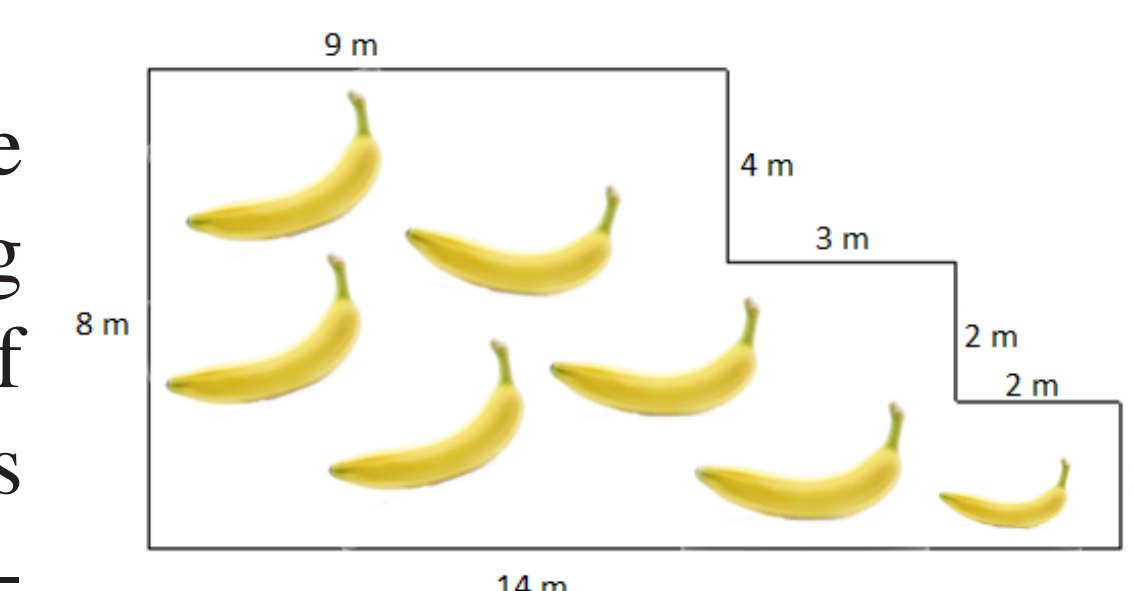
Grade 6:

In this lesson, students will work with the concepts of surface area, volume, and nets while learning about housing units around the world. Each page of a packet includes a picture of a housing unit along with cultural/historical information and the dimensions of the house in the picture. Students work together to answer questions about math and cultures that require them to make connections to their own culture.

Grade 9:

In this lesson, students will work with the concepts of graphing and linear equations while exploring population growth in different countries. Students will solve problems involving tables of values, equations of lines, and graphing lines that all model population growth in various countries and also research events that may have impacted each country's population growth.

Acknowledgements