NAZARBAYEV UNIVERSITY GRADUATE SCHOOL OF EDUCATION

The Role of Design-Based Research in the Development of Primary Level i-STEAM Curriculum in Kazakhstan

Gulfarida Myrzakulova
Kathy Malone
Janet Helmer
Gulnara Namyssova

Agenda

- Background information
- Research purpose
- Research questions
- Methodology
- Literature review: DBR and DI
- Tasks for the project
- Expected results

Background Information

- Research shows an overall lack of interest in engineering.
- Only 15% of students earn engineering degrees (OECD, 2014a).
- Less than 25 % of these degrees are completed by females (OECD, 2014a).
- Kazakhstani students at the 4th and 8th grades have difficulty using basic science knowledge (OECD, 2014b).

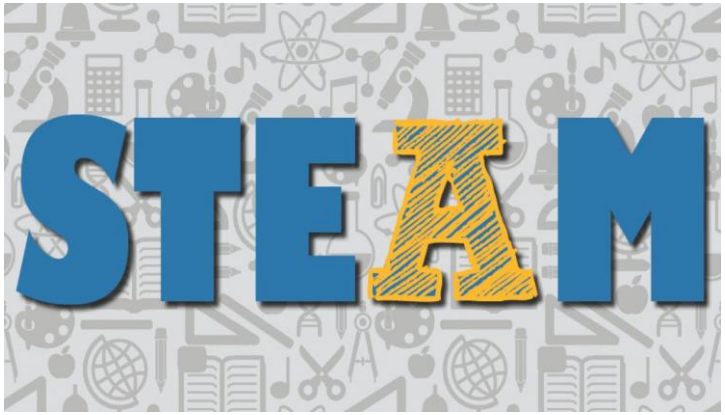
Literature Review

Correlated positively to greater **proficiency** in not only science but also reading and writing (Cirillo, DeMuro, &Young, 2008).

Increased student **engagement** (Brouillette, Childress-Evans, Hinga, & Farkas, 2014).

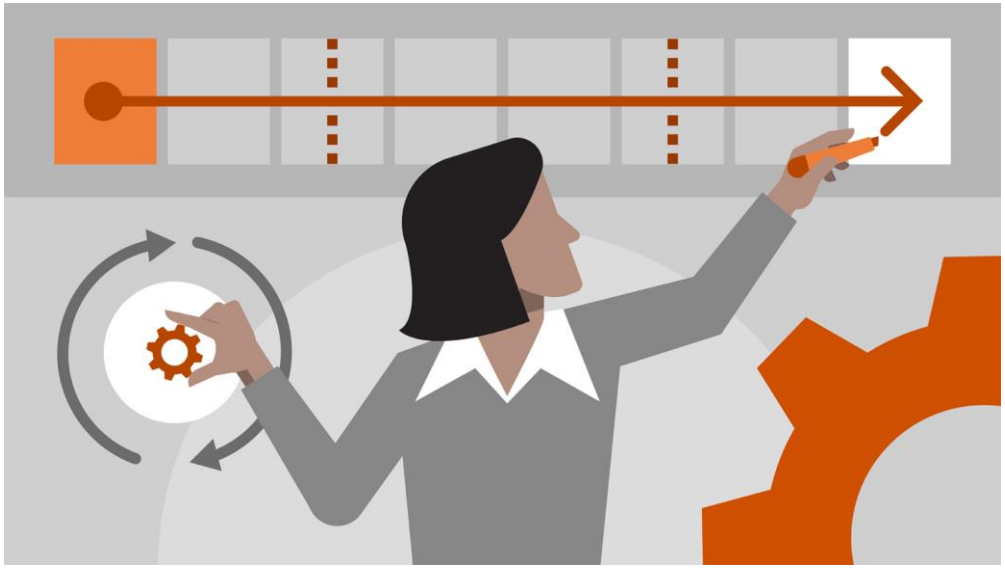
Improvement in **science concepts** and student engagement in 8 to 10 years old (as reported by teachers) (Graham & Brouillette, 2016).

Learners engage in more **science dialogue** (Warner & Anderson, 2004) and are more **enthusiastic** (McGregor, 2017).



Project Purpose

(1)The goal of this study is to examine the effects of the incorporation of dramatic inquiry (an arts component) into STEM units on students' conceptual understanding of engineering, technology, and science.



(2) Determine the effect of the i-STEAM units on students' engagement, engineering identity, competence and motivation about STEM topics and careers.

Research questions

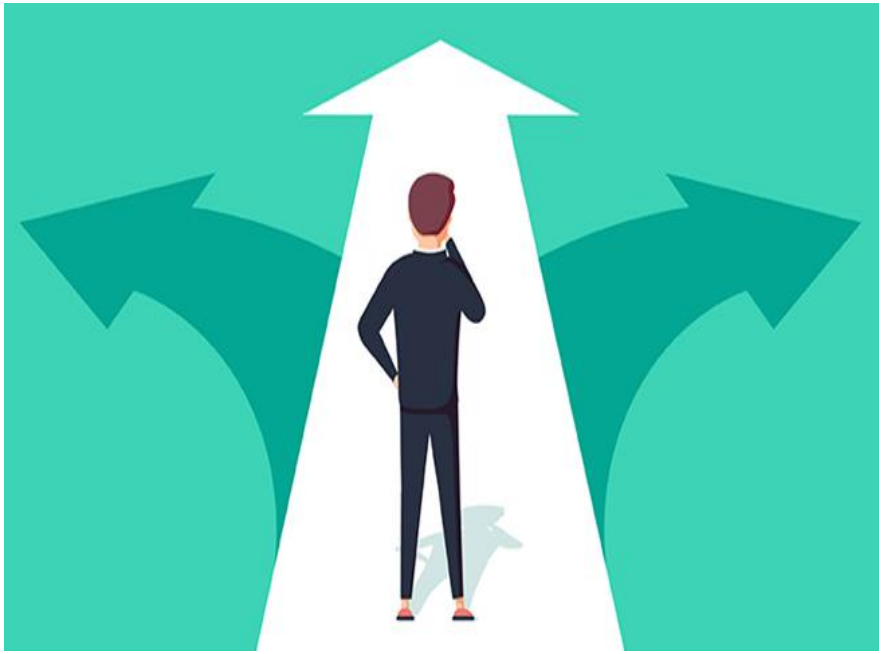
1. How does the incorporation of the A in STEM units (i.e., integrated STEAM units) impact primary student conceptual understanding in STEM topics?

2. How does incorporation of the A in STEM units impact primary student interest, engagement, motivation, identity and self-efficacy in engineering?

3. How does the incorporation of the A in STEM units impact student's engineering identity in primary classrooms?

Methodology

A mixed-method case comparison approach using design-based research that includes:

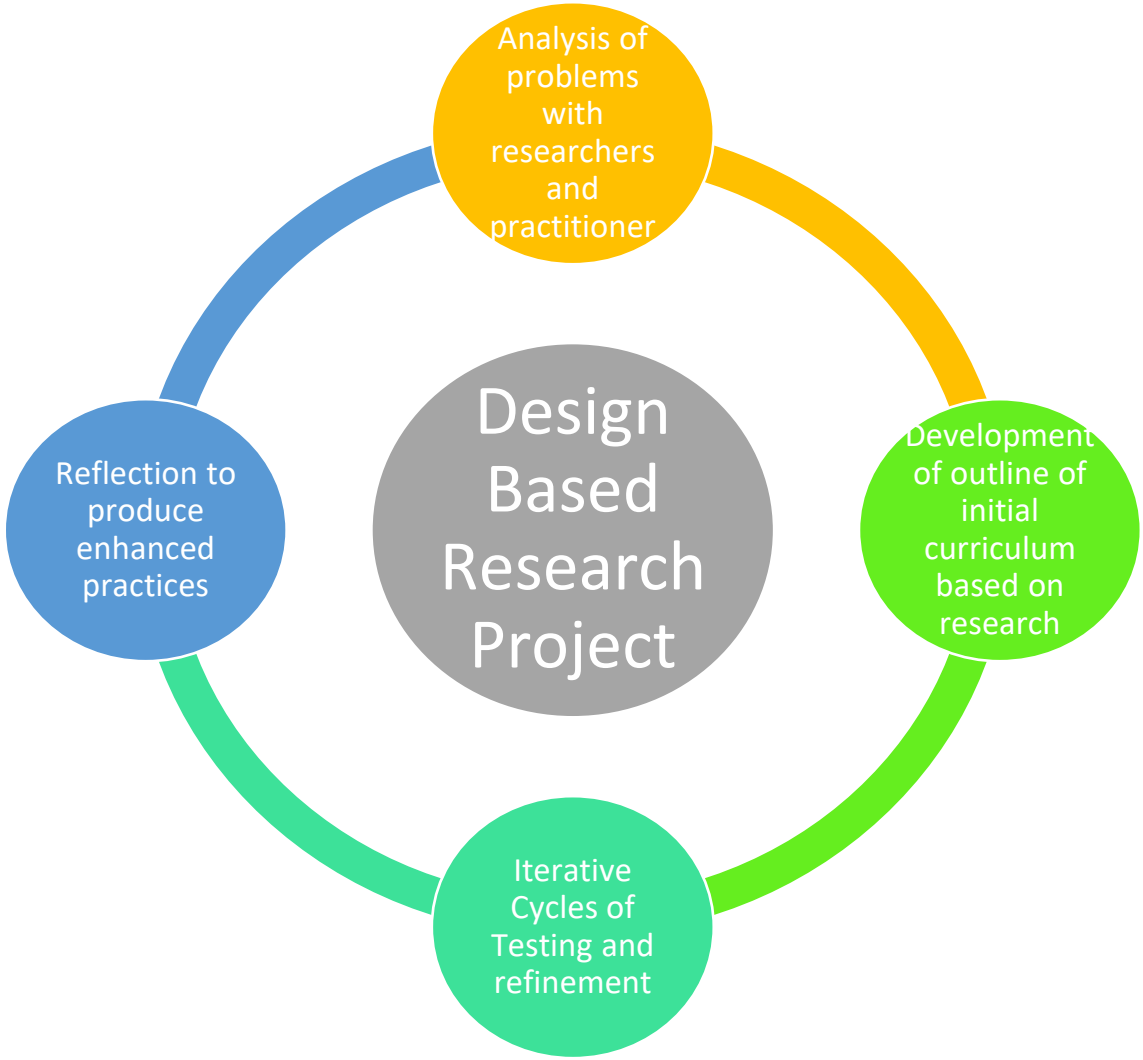


★ pre/post student assessments about engineering, technology, science and attitudes;

★classroom observations;

★pre/post student and teacher interviews;

What is Design-Based Research?



Study Context and Participants

The project will involve third grade teachers in Kazakhstan

The Brief Teaching Trial phase will consist of working with two primary school teachers in Nur-Sultan, each with about 20 students.

Following this, units will be revised then the project will enter into a Feasibility and Usability study

The teachers or schools will be randomly assigned to one of two conditions: i-*STEAM unit with Dramatic Inquiry* (n = 4), or *STEM unit* (i-STEAM unit with dramatic inquiry sections removed, n=4).

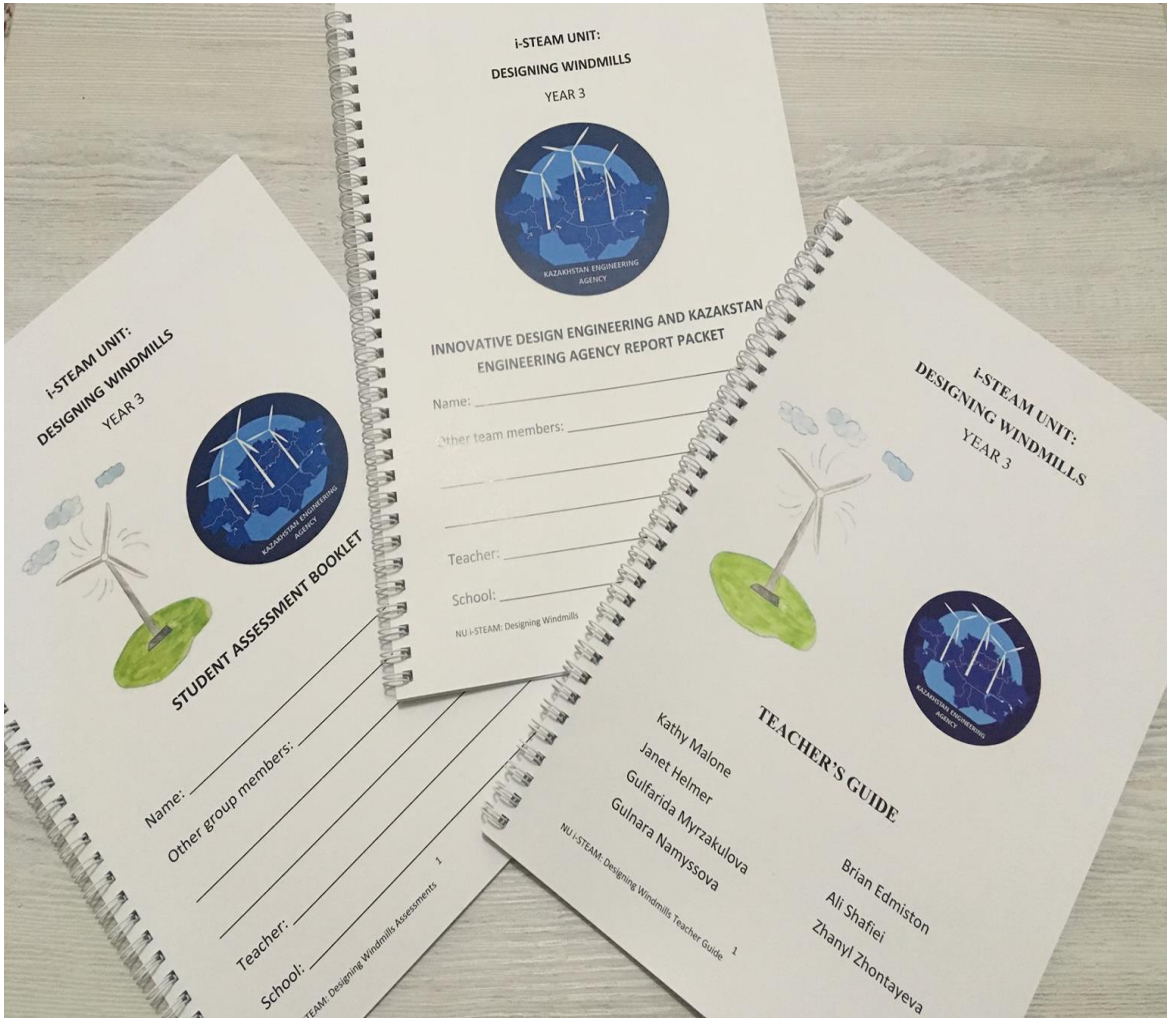
What is Dramatic Inquiry?

www.ecrp.illinois.edu

- Pedagogical approach known as 'Mantle of the Expert' (Heathcote & Bolton, 1995)
- Student may gain a deeper understanding of science concepts
- DI provides an interactive inquiry-based, learner-centered, collective education process.
- Elicits multiple perspectives through encouraging investigations emphasizing open-endedness.

I-STEAM Unit: Designing Windmills

- Students will design windmills.
- Take the role of professional engineers and scientists.
- "Commission" and "Signs" in DI

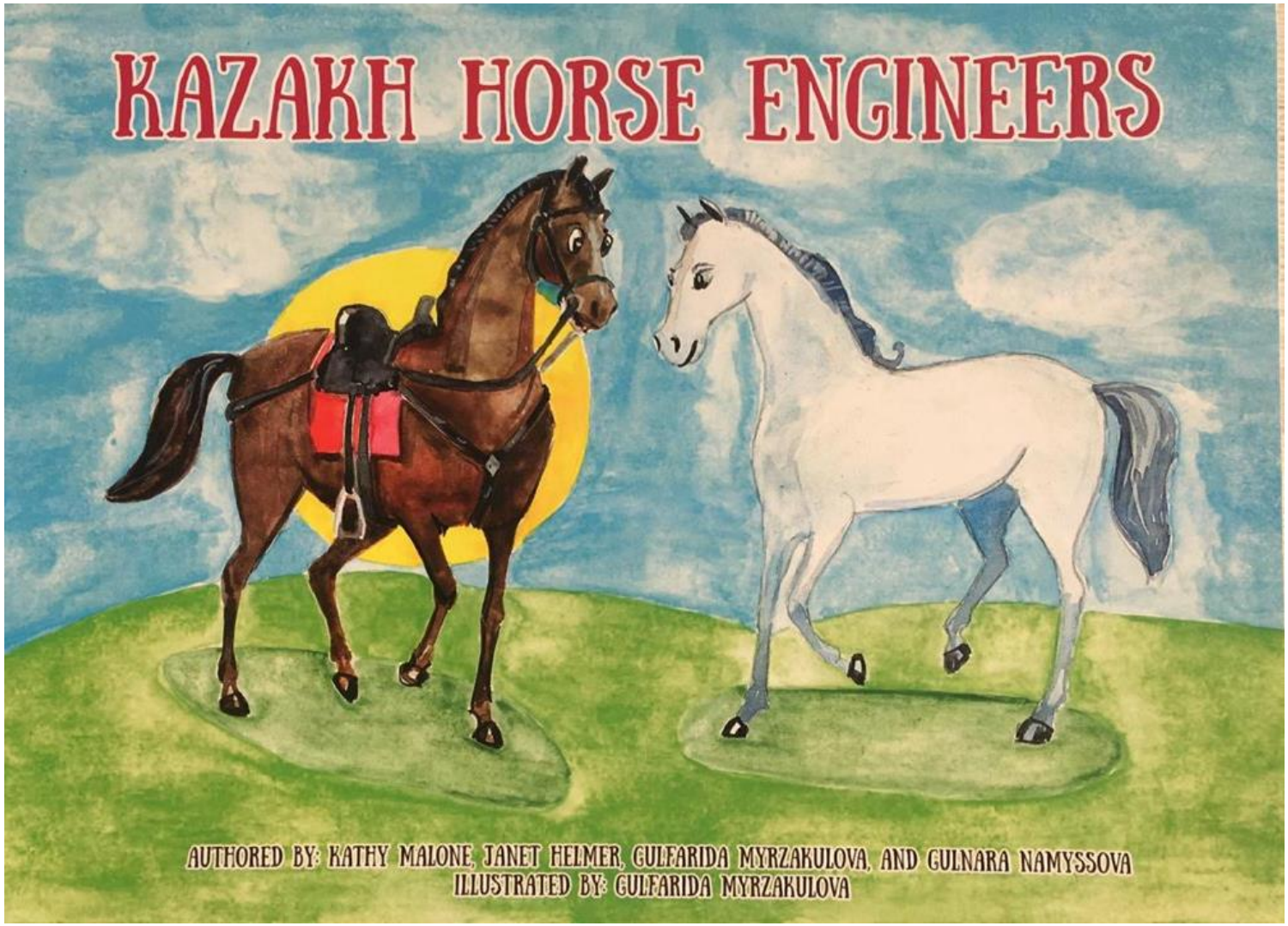


TECHNOLOGY FOCUSED ACTIVITY

Technology can be a object, system of objects or a process that solves a problem and are produced by engineers

- Tech in a Bag
  - Technological items are placed in a paper bag
  - Items include
    - single objects (such as a paper clip)
    - objects that are made of a system of multiple pieces of technology (such as post it notes or Kazakh Hat Kulakshyn)
    - technological process (such as canning veggies or making the Kazakh treat Kurt)
  - Students discuss
    - What the technology is used for
    - What it is made of
    - What other materials it could be made from
  - Then classes develop a group consensus for the definition of technology

Story book - “Kazakh Horse Engineers”

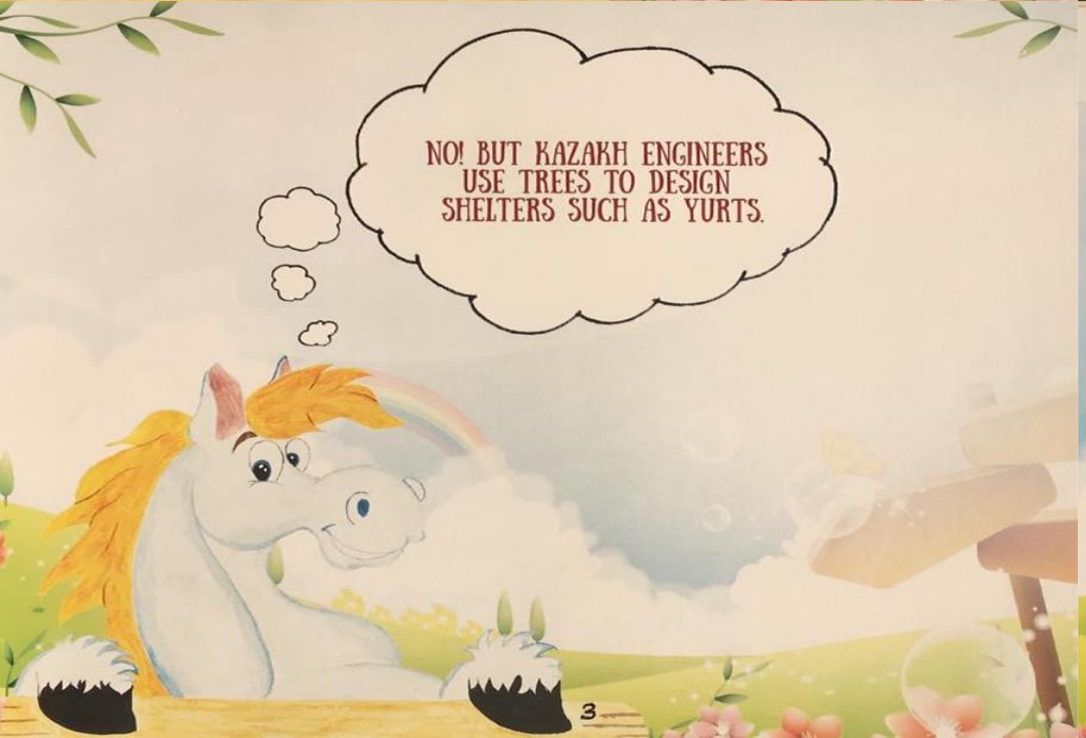



DO ENGINEERS CONSTRUCT TREES?

1


ARE YOU SURE?

2


NO! BUT KAZAKH ENGINEERS USE TREES TO DESIGN SHELTERS SUCH AS YURTS.

3

4

Expected Results

Students will develop an engineering identity as shown through dialogue with the inclusion of dramatic inquiry

Increases in knowledge of science concepts, engineering, and technology.

Increased interest in technology and STEM careers

We expect students in the i-STEAM unit to perform better on all these measures than the STEM group

NAZARBAYEV UNIVERSITY GRADUATE SCHOOL OF EDUCATION

Назарларыңызға рақмет!

Thank you for your attention!