Investigating the influence of PBL curriculum on prototyping to solve design problems: Predicting the behavior of systems and testing the validity of such predictions

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SECTION 1

Introduction
Definition

- Problem-Based Learning (PBL)
  - An instructional method where students learn through solving problems and reflection on their experiences (Barrows & Tamblyn, 1980)
  - Exhibited better clinical problem solving skills than traditional approaches (Albanese & Mitchell, 1993; Vernon & Blake, 1993)
  - Critical thinking, collaborative and self-directed learning promoted (Goh, 2014)
  - Significantly more effective than traditional instruction for promoting long-term retention of knowledge (Strobel & van Barneveld, 2009)
Definition

- Design Problem Solving
  - Most complex and ill-structured types of problems (Jonassen, 2000)
  - Iterative process (Jonassen, 2008) and definitely relies on solving problems (Silber, 2007)
  - Involve a large quantity of domain knowledge (De Vries & De Jong, 1999)
Definition

- Prototyping
  - A process of representation and provides answers for questions
  - A mindset of continuous learning, allow taking an idea and make it visible to others and find the root cause of a problem through the use of representations (McElroy, 2017)
  - Structure or system mock-ups (Blythe & Wright, 2006)
  - Tools for evaluation for design failure or success (Lim, Stolterman, & Teneberg, 2008)
Purpose

- How can we really help students to articulate complex design ideas and test the validity of their ideas?
  - Design problems are messy and require scaffolds
  - PBL literature has paid little attention to the nature of the problems (Jonassen & Hung, 2008)
  - Using systematic design, students are able to test about the predictions of their systems
  - What happens when an instructional approach is involved to aid a learning tool in the K-12 setting
Research Questions

1. To what extent does a student-centered (i.e., problem-based learning) curriculum on prototyping influence students’ understanding and interest of design problem solving?

2. What support do instructors need to implement a student-centered (i.e., problem-based learning) curriculum for solving design problems?
SECTION 2

Method
Research Context and Participant

- Locally chartered public school in a combined 6th, 7th and 8th-grade classroom in the Midwest
- Accustomed to implementing project-based curriculum for instructional purposes
- The school-wide yearly theme: ‘moment, momentum and movement’
- 33 middle school students and their teacher
- One-third students are labelled with special needs, however, the teacher identifies them as well-functioning students
Research Procedure

- A yearlong project where students engage in conversation of food and food justice
- Investigate how to grow more food and be sustainable with our food source
- Teacher engages students in a cross-disciplinary inquiry: How do we predict the behaviors of system and test the validity of such predictions?
- Building greenhouse prototypes using Virtual Reality (VR) and Augmented Reality (AR) technology
- Prototypes using VR/AR technology to test the validity of their systems
Research Design

○ A Case Study to focus on the students and teacher behaviors in order to gain a holistic view of real-world perspective (Yin, 2017)

○ **Exploratory Case Study** because it will provide an affordance of developing pertinent hypotheses and propositions for furtherer inquiry (Yin, 2017)

○ Allow conducting a fairly comprehensive, open-ended search of my interest, identify patterns and major themes associated with the phenomenon (Ogawa & Malen, 1991)
Data Sources

- Observational filed notes
- Student interviews
- Teacher interview
- Students’ prototypes
- Pre-and-post tests
- Student attitude survey
SECTION 3

Results
References


References


References


Thank you!

Questions or Comments?
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