KISSCE - ENGAGEMENT

Evidence in Action

A K20 Center Research Brief

Science Learning through STEAM Integration for Bilingual Students

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Introduction

This intervention brief explores the relationship between integrating arts with STEM (Science, Technology, Engineering, and Math) and its impact on science learning, particularly for emerging bilingual (EB) learners. The literature reviewed by Hughes et al. (2022) highlights the challenges faced by EB students in science education due to language barriers and the need for equitable learning opportunities. The research problem centers on finding effective methods to support EB students in science learning. The objectives of the study are to evaluate the efficacy of integrating arts with STEM (STEAM) and to determine the optimal order of implementing STEAM and STEM approaches. The significance of the research lies in its potential to enhance science learning and equity for EB students.

Methodology

Research Design:

The study employs a longitudinal experimental design with a pre-test, post-test, and delayed post-test assessment to measure the impact of STEAM and STEM integration on science learning.

Sample:

The sample includes fifth-grade students from nine Southern California schools, with a total of 301 students participating in the study. The sample is divided into two groups: one receiving STEAM lessons before STEM lessons (STEAM to STEM) and the other receiving STEM lessons before STEAM lessons (STEM to STEAM).

Data Analysis:

Data were analyzed using t-tests and ANCOVA to compare the change in science knowledge between the two groups and to assess the impact of implementation fidelity and language proficiency on learning gains.

Results

The study found that leading with STEAM lessons before STEM lessons significantly increased science learning gains for both English fluent (EF) and emerging bilingual (EB) students. EB students showed greater learning gains with the STEAM-first approach compared to the STEM-first approach, even in classrooms with low to moderate implementation fidelity. The

results suggest that integrating arts with STEM can provide a more inclusive and effective learning environment for EB students, reducing language barriers and enhancing engagement.

Application into Practice

To replicate this intervention in a school context, the following steps can be taken:

1. **Implement STEAM Curriculum:** Start with STEAM lessons that integrate visual and performing arts with science concepts, followed by STEM lessons that focus on inquiry-based science learning.
2. **Professional Development:** Provide comprehensive training for teachers on both STEAM and STEM methodologies to ensure high implementation fidelity.
3. **Structured Lesson Plans:** Develop detailed lesson plans that incorporate arts elements such as dance, music, visual arts, and media arts, aligned with NGSS standards.
4. **Regular Assessments:** Conduct pre-tests, post-tests, and delayed post-tests to monitor student progress and measure the effectiveness of the intervention.
5. **Support for EB Students:** Offer additional resources and support for emerging bilingual students to help them overcome language barriers and fully engage in the learning process.
6. **Collaborative Learning:** Encourage group activities and collaborative learning to leverage social interactions and enhance cognitive and emotional engagement.
7. **Creative Expression:** Use arts-based strategies to allow students to express scientific concepts creatively, reducing anxiety and increasing engagement.
8. **Feedback and Adaptation:** Continuously gather feedback from teachers and students to adapt and improve the curriculum based on their experiences and needs.

Implementing these steps can help schools replicate the intervention effectively and enhance science learning for all students, particularly emerging bilingual learners.

Work Cited

Hughes, B. S., Corrigan, M. W., Grove, D., Andersen, S. B., & Wong, J. T. (2022). Integrating arts with STEM and leading with STEAM to increase science learning with equity for emerging bilingual learners in the United States. *International Journal of STEM Education, 9*(58) https://doi.org/10.1186/s40594-022-00375-7