ABSTRACT

The goal of this project is to develop and pilot test a limited number of free computer-based instructional activities that improve student graph comprehension, aimed especially at science students in grades 7 and 8. In addition, the project is developing a pilot assessment instrument focusing on students’ comprehension of graphs (“graph literacy”). The activities and the assessment instrument are being pilot tested in Maine, a rural state where family income is below the national average and students are underrepresented in studying STEM topics after high school. The state has identified this topic as an important one to focus on in the coming year.

Graph literacy is the ability to identify the important features of a wide variety of graphs and relate those features to the context of the graphs. This increases the students’
understanding not only of how to interpret graphs, but also of the science content. This
definition of graph literacy, while based in the math and science standards, goes beyond
skills tested by many assessments of graph knowledge because they focus primarily on
reading points off a graph, typically a type of graph that students have studied and are
familiar with. While broadening the usual definition for graph skills, the project focuses
on scatter and line graphs of the type encountered in many mathematics and science
courses in grades 7–12, as well as in newspapers and magazines.

Graphs are central to STEM learning in many subjects and at almost all education levels.
In spite of the vital role of graphs, students at all ages demonstrate difficulties using and
interpreting graphs. The computer-based Graph Literacy activities being developed are
based on extensive prior research about students' use and understanding of graphs, as
well as continuing advances in delivering education activities through dynamic,
interactive Web pages that do not require schools to install any software. Based on the
research literature, there is a consensus that students need to be taught graph literacy in
three steps: identifying and encoding the important superficial features of a graph they
want to understand, such as the titles, units, and axis labels; linking visual features of
that graph to mathematical relationships, based on recurring patterns (e.g., linear
increase or decrease); and, integrating all of these features with the context of the
graph. The activities we are developing are based on this approach, as are the validated
assessments being developed to measure students' graph literacy.

The project is conducting a small, randomized experimental trial of the graph literacy
activities in year 2 of the project. The goal of is to determine the effectiveness of the
graph literacy activities in improving students' understanding of graphs. The open source
software and approaches developed under the prior grant contribute directly to the likely
success of this project. Because of growing interest in use of online resources for
teaching and learning, this work is potentially transformative for a wide range of
audiences, including teachers, students, researchers, and the developers and publishers
of instructional materials across all STEM areas and grades. The underlying software
technology for Graph Literacy is being made available as open source computer code, and
any activities that use the code are released under a creative commons license. As a
result, the graph literacy activities, and the pilot assessment instrument, can be widely
adopted at no cost.

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