The Genomics Analogy Model for Educators (GAME): The Effectiveness of the Lego® Analogy Model in Teaching Gene Sequencing and Biotechnology in High School Classrooms

Rebecca Rothhaar, Barry R. Pittendrigh, Kathryn S. Orvis

Web address: http://www.entm.purdue.edu/legogenomics/

Abstract

Research in biotechnology is rapidly advancing; everyday new and exciting discoveries are made, but with this new technology also brings with it many safety and ethical questions as well as the need for education. Alternative teaching methods may help to increase students understanding of difficult concepts in all aspects of schooling including math, science, genetics, and biotechnology. The Genomic Analogy Model for Educators (GAME) is a teaching tool currently under development, made up of three different pieces: (i) a CD Rom, (ii) a website and (iii) laboratory exercises. The GAME model uses simple analogies of easily understandable concepts to explain the technical and scientific aspects of modern genomics; the first module is the Lego© Analogy Model (LAM) which focuses on DNA sequencing using the Sanger method and electrophoresis. The purpose of this study was to evaluate the effectiveness of the GAME model on high school students. In addition, the short term effect of the GAME model on high school students' attitudes about biotechnology was also measured. Results show a positive change in students' posttest scores after participating in GAME which indicates the effectiveness of this new tool for biotechnology education.


********************************************

Genomics Analogy Model for Educators (GAME): from jumping genes to alternative splicing

Joanie Corn, Kathryn S. Orvis, Barry R. Pittendrigh

Abstract

Studies have shown that there is usually a lack of understanding concerning the fields of genetics and genomics among high school students (Lewis and Wood-Robinson, 2000). A recent article (Kirkpatrick et al., 2002) introduced the GAME (“Genomics Analogy Model for Educators) model and two of its components: (1) explaining
sequencing technology with Lego® blocks, and (2) using a small town analogy to explain cellular biology. GAME is a computer-based tutorial that uses simple analogies to convey scientific information. STAM (Small Town Analogy Model) is a unique way of explaining many aspects of molecular biology and genomics, such as transcription and translation. In this article, STAM has been expanded to include a more in depth look at genomes, by covering the topics of jumping genes, the C-value paradox, and alternative splicing.


************************************************************************************************

**Genomic Analogy Model for Educators (GAME): a teaching model for biotechnology and genomics education.**

Gretchen Kirkpatrick, Kathryn S. Orvis and Barry R. Pittendrigh

**Abstract**

Although genomics and genetic engineering are transforming the way we do science and the way we live, there is a distinct lack of understanding about the basics of molecular biology in the general population. We present the GAME (“Genomic Analogy Model for Educators”) strategy for making concepts in genomics easily understandable for both students and the general population by using familiar objects and concepts associated with daily life. These analogies have been turned into web-based tutorials and accompanying laboratory exercise that are intended to be used by students studying biotechnology, genetic engineering, or genomics at a high school level. These tutorials are expected to help students, as well as adults, understand some of the fundamental aspects of biotechnology and genomics.


**************************************************************************************************
An Evaluation of the Junior Master Gardener® Program in Third Grade Classrooms.

Amy Dirks and Kathryn Orvis

*Junior Master Gardener, JMG and associated logos are registered service marks of the Texas Cooperative Extension, The Texas A&M University System.

Abstract. Studies have shown gardening to have the potential to influence students in several positive ways. The hands-on and informal learning that occurs in these outdoor areas can be incorporated into all areas of the curriculum, fostering environmental awareness and increased interest in science. Junior Master Gardener (JMG) was chosen to be evaluated in 14 Indiana third grade classrooms as little formal classroom usage data exists for the program. It was hypothesized that the use of the program could help improve agriculture awareness and knowledge in youth. Quantitative and qualitative instruments and observations were utilized in an effort to evaluate knowledge gain and change of attitude towards the topics covered by the JMG curriculum; science, horticulture, and the environment. Student pre and post test results indicated overall significant gains in knowledge and attitudes. Performance was not attributed to student age, gender, race, or location of the school, although those schools with a garden achieved more positive gains in attitude and specific performance varied according to classroom. Qualitative data also indicated that the students enjoyed the program, shared what they learned with others, and wanted to participate in more JMG and gardening type activities. Teachers indicated that they were satisfied with the program in their classrooms and planned to reuse their JMG materials for future classes.


*******************************************************************************

A Case Study of the Mighty Morris Blooms: Quantitative and Qualitative Program Assessment of a Youth Gardening Program in a 3rd Grade Classroom.

Amy Dirks and Kathryn Orvis

Abstract. Research has shown that hands-on, experiential learning is very effective in the classroom and school gardening utilizes this method of learning. Gardening has
been shown to have many positive effects on children including in academic areas. Of the youth gardening programs that exist, little research has been done with the Junior Master Gardener® program to evaluate it for its use in the classroom. JMG® is a youth gardening program designed to teach aspects of horticulture and environmental science through hands-on activities in both informal and formal learning environments. A case study of one particular classroom evolved from a larger evaluation study of the JMG® program in Indiana third grade classrooms. Research with this classroom utilized a mixed approach to acquire quantitative and qualitative data of knowledge and attitudes towards science, horticulture, and the environment. Quantitative measurements were made pre, post, and post-post (after summer break) the program. Qualitative methods included weekly classroom observations during the study, student post and post-post program evaluations, and post program teacher evaluations. Results indicated that students had significant levels of knowledge and positive attitude gain from pre to post tests. Observations and evaluations supported the quantitative results showing that the students and teacher found the JMG® program to be valuable in the classroom, as well as enjoyable which may lead to more student interest in science. Through this case-study post-post program assessment showed that the students retained a significant amount of positive attitudes towards science, horticulture and the environment.