

AN INNOVATIVE APPROACH TO TEACHING STEM: ROBOTICS AND AUTOMATION

Stephen B. Richter, Computer Science Department, West Chester University, 700 S High St, West Chester, Pennsylvania, 19382, srichter@wcupa.edu, 610.436.3530

Jack M. Rappaport, Brilliance Consulting, Ambler, Pennsylvania, 19002, rappaport.jack@yahoo.com, 215.252.6453

Dennis T. Kennedy, School of Business, La Salle University, 1900 West Olney Ave, Philadelphia, Pennsylvania, 19141, kennedy@lasalle.edu, 215.951.1363

ABSTRACT

This paper describes and implements an innovative model for teaching Science, Technology, Engineering and Mathematics (STEM) that enhances student comprehension and retention, as well as serve as a motivational tool to study STEM disciplines.

The model creates analogies and metaphors for various STEM topics using the contents of popular music videos. We cite theories from the fields of education, psychology, philosophy, linguistics to support our model. Theories of neuroscience, the interdisciplinary study of the nervous system, play a particularly important role in describing and validating our educational model. Concepts such as, embodied cognition, mirror neurons and the connection between emotion and cognition, are used to explain how the brain processes the information and multi-modal stimuli generated by our model.

Emotions play an important role in our model. Emotions and feelings can be triggered by the images, dance and music of the videos and can be powerful tools to increase student engagement and retention as well as create personal empathy with information in the presentation. Positive emotions and feeling can also reduce stress which can be a barrier to learning. Neuroscience tells us that effective cognitive processes are not possible without the motivation and meaning provided by emotional input. Neuroscience theory also provides ample evidence of the connection between the emotions induced by music and brain activity. For example, emotions induced by music activate similar frontal brain regions compared to emotions elicited by other stimuli.

Dance plays a significant role in our model because it represents a core element in many if not most popular music videos. Many students like to dance primarily in social situations and as a means of self-expression and often identify with their favorite pop dancing stars. The dance of popular music videos can be used to create a personal bond or sense of empathy between students and the STEM topics when used in a metaphorical context.

The model was implemented using the topic of robotics and automation with a group of university and high school students and teachers. The impact of the model was evaluated using the National Science Foundation (NSF) frameworks for evaluating informal science projects. The results indicate that the model using symbolic transformation to teach STEM can have a significant impact on students' attitude towards STEM and their decisions to choose careers.

