Play Pedagogy, STEM, and Inquiry:

Using Mousetrap Cars to Bridge Metacognition

Play Pedagogy, STEM, and Inquiry:

Using Mousetrap Cars to Bridge Metacognition

Education has entered an exciting era as a result of increasing emphasis on integration of science, technology, engineering, and mathematics (STEM). Many educators share this enthusiasm but may not know how to successfully accomplish the goals of STEM. Although there are a variety of approaches to STEM, one way to increase both student motivation and learning outcomes is through play pedagogy and inquiry learning. Research suggests that strategies that increase metacognitive skills also impact critical thinking skills. These skills are ideal building blocks for creating a solid foundation for STEM.

In classes that utilize STEM, teaching metacognition is imperative because students have to produce more than procedural solutions. Higher-order thinking is a necessary skill for all students who anticipate collegiate ranks after high school. Therefore, educators who seamlessly integrate metacognitive skills will best prepare students to be competitive. Metacognitive skills include (a) problem solving, (b) team planning, (c) collaborative learning, (d) evaluating, (e) analyzing, and (f) monitoring of goals. The use of traditional design approaches, such as trial and error, is less effective than a design that encompasses applied theory (Cotton, 2002). By applying theory to selected problems of practice, students will be able to replicate true design scenarios in trying to predict a desired outcome.

Developmental theorists believe that young children engage in playful manipulation and exploration of objects, which later develops into *mature play* involving creativity, dramatic play, and playing games with others while negotiating rules and roles (Bodrova & Leong, 2003). This mature play is considered crucial for children to develop cognitive skills, social skills, and language skills (Bodrova & Leong, 2003). Meaningfully structured play that is guided and facilitated by adults is necessary for the full development of self-regulation and problem solving skills (Baker, 2012). Structured play is directly related to authentic student engagement, which increases intrinsic motivation and leads to authentic student products.

In our completed practice project, students in the tenth grade explored the construction of mousetrap cars. Student interest and motivation was piqued while exploring mathematical models and science constructs through a process of engineering design (McGrew, 2012). Students had to construct a car, provide an evidentiary portfolio of their findings, take images throughout the entire process, and present their findings through the use of technology (Down, 2003). Students were given one week to complete the project and make upgrades to their cars to increase its distance performance. Educators know and understand the value of "fun math" that engages student metacognition even when high levels of rigor are not articulated to the students (Roberts & Gonzalez-Espada, 2006). Students were eager to work cooperatively in teams and plan how to construct a winning car.

In an effort to help educators understand the importance of play pedagogy and the

influence it has on metacognition in the classroom, the presenters will be engaging the audience in their own mousetrap car build. The audience will be given a mousetrap kit and the project portfolio that was used in the classroom project. Audience members will be asked to partner together in order to enrich the experience using collaboration of thought. Scholarly discussions will be generated throughout the presentation between the presenters and audience. It is the goal of the presenters to incorporate metacognition at the scholarly level. Recommendations for similar STEM activities, that integrate play pedagogy and inquiry learning strategies, will be generated collaboratively by the presenters and audience for K-12 grade levels.

References

Baker, L.M. (2012). Fun and games: Connecting and learning. *International Journal of Disability, Development and Education, 59*(1), 119–123.

Bodrova, E., & Leong, D. (2003). The importance of being playful. *Educational Leadership, 60*(7), 50–53.

Cotton, S. (2002, November). Making problem-solving simulations more realistic. *Technology Teacher, 62*(3), 29-32.

Down, P. (2003). Identifying career options with a better mousetrap (car). *Technology Teacher, 63*(1), 15-17.

Jones, R.A. (2012). What were they thinking? Instructional strategies that encourage critical thinking. *The Science Teacher, 79*(3), 66–70.

McGrew, C. (2012, March). Engineering at the elementary level. *Technology and Engineering Teacher, 71*(6), 19-22.

Roberts, E., & Gonzalez-Espada, W. J. (2006). Snap! Catch student' attention with mousetrap vehicles. *Tech Directions, 65*(10), 15-18.