MULTIPLE REPRESENTATIONS AS PRODUCTIVE TOOL IN TEACHING PHYSICS

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Physics is considered as the most problematic area within the realm of science, and it traditionally attracts fewer pupils than chemistry and biology. Physics is perceived as a difficult course for students from secondary school to university and also for adults in graduate education. In developed countries, it has been determined that goals of science are never fully realized, that student success in physics is lower than chemistry and biology, that students do not like science lectures and that most have no preference for science, particularly physics (Boylan, 1996; Dieck, 1997; Mattern and Schau, 2002; Neather, 1991; Rivard and Straw, 2000).

Moreover, one of the problems that confront physics subject, whether in high school or universities, is the difficulties of the students in solving a physics problem. The “Trend in International Mathematics and Science Survey” or TIMSS result showed that there is decreasing level of achievements in Science in different countries since 1995 to 2011 and one of the variables identified was the difficulties of the students in problem solving particularly in Physics Concepts.

One factor that may affect students’ achievement is the teaching approach that a teacher adopts. Therefore, use of appropriate teaching method is critical to the successful teaching and learning of Physics. Research on learning strategies shows that there is a relationship between the use of learning strategies and achievement in various academic disciplines (Green & Oxford, 1995; Yumusak, Sungur, & Çakiroğlu, 2007; Shin, Jeon, & Yang, 2010). Because of this, science teachers are always find an effective strategies as well as technique on how to teach Physics in a very easy and understandable way. One of the best ways to deal with it is by the use of used multiple representations. It is considered as an important element in the course of teaching and learning Physics.

The role of multiple representations played in physics problem solving is vital. The multiple representations have been recognized as an important determinant of problem-solving performance. A correct and adequate problem representation is a basic requirement for fluent reasoning towards a solution. The use of multiple representations can be used to support to abstraction (Cooper & Warren, 2011; Ross & Willson, 2012). Specifically, representation forms that scaffold the students’ understanding by moving the student from using real-world and concrete representation forms to those more abstract can be fruitful.

In addition, there are varieties of representation forms that open the possibilities of how students can communicate their mathematical and conceptual understanding. It is important to clarify the distinction between models and representations.

Cooper and Warren (2011) describe the difference as the following: “models are ways of thinking about abstract concepts (e.g., balance for equivalence) and representations are various forms of the models (e.g., physical balances, balance diagrams, balance language, equations as balance)”. Using multiple representation forms provide a chance for a group of students with diverse ability levels to become engaged in problem solving. Teacher may use multiple representations in assessing their students’ understanding towards the lesson discussed. Farayola and Salaudeen (2009) also opined that problem solving is a complex...
mental process that involves visualizing, imagining, manipulating, analyzing, abstracting and associating ideas.

Importantly, multiple representations allow students to experience a variety of modes to communicate science. The multimodality of multiple representations (visual, auditory, kinesthetic, and tactile) allows for multisensory experiences. Additionally, when using multiple representations, students of all learning styles will have a better chance of finding a representation of interest to them (Oberer, 2003).

References: