An Automated Symbolic Package to Enhance Higher Order Thinking Skills (HOTS): Critical Thinking

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The aim of this Computer Algebra System-Critical Thinking (CAS-CT) project is to enhance Higher Order Thinking Skills (HOTS) (critical thinking) by applying Problem Based Learning Method (PBLM) [1] using a symbolic package (named as i-phys 2.0). The focus area of i-phys 2.0 is physics (force and motion) for high school students in Malaysia. The technical design of the development of i-phys 2.0 is based on the CAS pedagogy characteristics concept (i.e., interactivity, visualization, experimentation, step by step technique, multiple representations and white box/black box principle) [2]. The learning model to develop i-phys 2.0 is based on Bloom's Taxonomy [3] (see Figure 1) . i-phys 2.0 is also design for web based users wherein teaching and learning can be done online. PBLM is applied using i-phys 2.0 through teamwork to sharpen the student's ability to criticize opinion, express thoughtful ideas and give relevant proposals to solving problems. This is important as the market demand nowadays not only require workers that possess academic excellence but also generic skills (i.e., critical thinking, teamwork, positive thinking and leadership traits) [4]. The mastery of scientific numeracy and literacy via the application of i-phys 2.0 provide solid foundation to develop diversity skills to seize job opportunities particularly in the field related to STEM (Science, Technology, Engineering and Mathematics). i-phys 2.0 is also intended to nurture self confidence, fun in learning and strong desire to continuously acquiring knowledge especially in the work life. Usability testing of i-phys 2.0 is based on attributes: effectiveness, learnability and satisfaction. Each attribute contains usability criteria that is CAS pedagogy characteristics concept and tested using Pre Experimental One-Shot Case Study. After treatment using i-phys 2.0, post testing is conducted to determine the assessment level of achievement score in critical thinking. I-phys 2.0 is a continuation and enhancement of i-phys developed by Hazlina [5].

Keywords
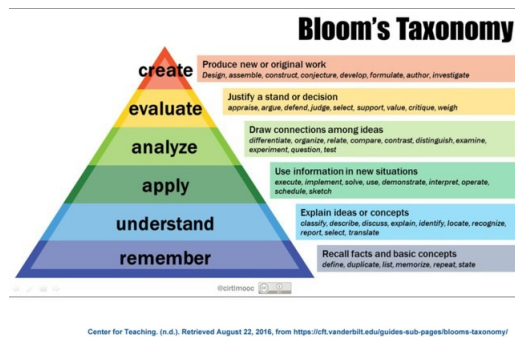Symbolic package, Critical thinking, Bloom's taxonomy, Problem Based Learning Method (PBLM).

Figure 1: Bloom's taxonomy

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