**Teaching the Art of Fault Diagnosis in Electronics by a Virtual Learning Environment**

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This article explores the need for the development and deployment of virtual learning environments (VLE’s) which can provide adequate training in developing the art of fault finding on a variety of electronic circuits for first year electronic undergraduate students. Experience has indicated that the initial practice of testing and fault finding is where most students have the greatest difficulty, .i.e. putting theory into practice.

Computer simulation of circuit parts was used in an attempt to improve understanding, but the authors considered that the use of computer simulation did not achieve all the learning objectives set out. Instead of having an in depth understanding of circuit function in a physical laboratory, it was found that many students had a great deal of trouble in relating real world measurements to those found in a simulated setting.

As a result of these findings extra fault finding learning resources were incorporated into the electronics module. Fault finding is normally divided into generating a hypothesis or supposition and then testing this supposition using a variety of diagnostic test equipment. When a student is initially asked to draw hypothesis about the nature of a fault(s) on a piece of electronic equipment, an initial consideration will be problem recognition, the fault under investigation can only be accurately identified if the student is capable of systematic, logical and rigorous analysis of the features displayed by the fault.

Running a series of typical faults, and learning the correct sequence of measurements and investigation that should be followed, will typically allow the student to build experience, knowledge and confidence in their fault finding abilities, the provision of a VLE should act to accelerate this process. The VLE under consideration was made from a series of web pages, it gave an introduction to fault finding principles, described the test equipment required, presented fault finding and functional block diagrams of the D.U.T. (Device under Test). The lesson concluded with an online instructional quiz and eight simulations. When tested for the effect of the intervention, the authors identified areas that improved when compared with the pre VLE and simulator results, for those who used online material and simulator, more students got their chargers working than those who did not, pre resource ratio was 15 to 13, the post resource ratio of 21 to 9 (working chargers). The intervention also demonstrated an improvement in the ratio of students that could identify circuit elements within a schematic—an important skill required for fault finding, comparing pre and post intervention results.

 This VLE as described has practical implications for the direction, content, layout and deployment of my eResource; it is vital that my electronics app gives consideration of the fact that developing skills in fault finding will require practice on real faults or simulated faults close to the real situation. From my readings of this article I will further explore if practical concerns will allow me to incorporate a fault simulator into the app design. If properly designed, a fault simulator can allow the student to explore the circuit, identify circuit properties, and give direct feedback to the user on whether his/her responses were correct.

This learning approach is underpinned by a theoretical rationale, the strategy fits within the framework of adaptive character of thought (ACT) developed by Anderson at Carnegie-Mellon University. “In the Adaptive Character of Thought (ACT-R) theory, complex cognition arises from an interaction of procedural and declarative knowledge, according to the ACT-R theory, the power of human cognition depends on the amount of knowledge encoded and the effective deployment of the encoded knowledge”. Anderson, JR (1996).

**Reference:**

Anderson, J, R. (1996). 'ACT', American Psychologist, 51, 4, p. 355, Academic Search Complete, EBSCOhost, viewed 3 January 2013.

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