**Motivations**

- Information Security Skills
- Distance Learning
- Collaborative Learning
- Hands-on Learning
- Technology Transfer
- Inquiry-Based Learning

**Project Summary**

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- CVCLAB
  - http://list.bk.psu.edu/cvclab

**Impact of Collaborative Work**

- Can collaborative work enhance student learning in virtual computer laboratories?

**Findings**

- Virtual computer laboratories should not only provide students with an environment in which they can experiment with critical skills in isolation but also opportunities to interact with one another.

**Experimental Design**

In the CVCLAB, we conducted controlled experiments using two hands-on activities, a computer networking activity (NT) and a database administration activity (DB). We created two versions of the activities, Group Work (GW) and Individual Work (IW). The GW version was designed in a way that two students had to depend on one another to complete the activity. Data was collected using a survey and a post test.

**Discussions**

GW students rated the activity and their learning experience in the CVCLAB as more valuable.

Peer-to-Peer learning emerged as a significant factor.

**Ongoing Activities**

- Continue data collection
- Focus on online education
- Model building (Structural Equation Modeling)
- Journal articles
- New hands-on activities
- Summer camp, July 8-13, 2013
- Reading High School field trip, May 9, 2013

**Statistical Analysis**

Comparison of the Construct and Post Test Averages between the Control and Treatment Groups

**Impact of Activity Design**

- What is the best way to design hands-on activities for virtual computer laboratories?

**Findings**

- We can foster more comprehensive learning by including all stages of Kolb’s Experiential Learning Cycle in hands-activities.

**Experimental Design**

- The Control Version included only the concrete experience (CE) stage.
- The Treatment Version included all stages of Kolb’s Experiential Learning Cycle.

**Statistical Analysis**

- All factor loadings ≥ 0.71
- All Cronbach’s Alpha values ≥ 0.74

**Discussions**

- The treatment group performed better in the post test.
- The treatment group indicated a higher level of perceived learning (competency).
- The treatment group was more likely to state that the activity increased their interest in the subject matter.