Session 4:
Delving into RM-ET
Research Study Presentation
by
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Under the guidance of Prof. Santosh Noronha
What is the problem I am trying to address?

• In a programming course, some students are not able to
  – understand concepts in programming such as flow control, function calls, pointers
  – take decisions on the use of various constructs

• Some practice is obtained in labs, but not enough, especially for weak students

• Need instructional material for above, preferably for self-learning and extra practice
What solutions I proposed?

I plan to use available technology-enhanced instructional material to address my teaching problem (students who need practice in programming)

Use virtual labs to help students

• Understand the concepts
• Make decisions on the use of constructs suitable for a particular application
Lab work needed for practice

Students should understand concept

Self paced learning and extra practice

Use TEL Virtual labs

My idea
Welcome to the Computer Programming Lab developed at IIIT Hyderabad. The interactive experiments in this lab will give the students an opportunity for learning and better understanding of the basic concepts and constructs of computer programming.
What the teacher will do?

1. Select the topic which the students find difficult to understand
2. Find a virtual lab suitable for the topic
3. Check for the correctness of the lab
4. Find out if students are ready to work in the new technology labs
5. Design the study

What the students will do?

- Students will carry out experiments using the virtual lab
Positioning My Work
Comprehensive literature survey carried out

Results

What exists?
- virtual labs have been used in the teaching learning process in other countries
- Most studies are based on attractiveness “Do students like VL? Are they motivated?” [1,3-7,9,10,12-20,22]

What is missing?
- Very few studies on Effectiveness: “Do students learn content using VL” [2,8,11,21]

GAP
- How the faculty can effectively use these labs in their teaching?
- Need for providing guidelines to the faculty who wish to integrate these new technology labs in improving the student learning.
Research Questions?

1. Can virtual lab help students with low performance more in understanding concepts in programming than students with high performance?

2. Can virtual labs help students take decisions on the use of control flow constructs suitable for a particular application?
How do I know my idea is working?

Design of my study
Learning objectives

• To learn how decision making is done while programming.
• To learn about the various simple constructs used for control flow. (for loop, if, else if, switch case etc)
• To learn about the various advanced constructs used for control flow in order to achieve repetition of instructions.(nested if, while etc)
Details of experiment/study

- Virtual lab selected VL1: [http://deploy.virtual-abs.ac.in/labs/cse02/index.php](http://deploy.virtual-abs.ac.in/labs/cse02/index.php)
- **Participants**: second year undergraduates from Industrial Electronics branch from a self-financed engineering educational institute
- **Sample size**: 54
- **Research Design**: One-Group Pretest/Posttest Design
  
<table>
<thead>
<tr>
<th>O1</th>
<th>X</th>
<th>O2</th>
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- **Measurement Tool**: Pre-test and Post-test
- **Operationalization**: difference in pre-test and the post-test scores.
- **Topic**: Basic and Advanced Flow Control
- **Number of questions**: 20
Concepts covered in theory class
Students were appraised about the lab related to the concept

Students performed experiment in traditional lab

Pre-test Conducted

Implementation Process

Conduct Post-test

Students perform the experiment using virtual lab

Make out the difference

09-02-2013
What else did I have to worry about?

– How students for study are selected?
All the students were second year diploma students
– What did I measure to show that my idea works?
Difference in the Pre-test and Post-test Marks
What did I measure to show that my idea works?

- Divided the students into two categories
  - Marks≤7 (40%) - Low Performers
  - Marks>7 - High Performers

- Calculated difference between Pre-test and Post-test Marks

- Paired Sample Test for Pre-test and Post-test of all students
- Paired Sample Test for Low and High Performing students Pre-test and Post-test
What I had to worry about?

### Validity

<table>
<thead>
<tr>
<th>Content</th>
<th>If not valid then results are not acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Am I really using the labs matching my objectives?</td>
<td></td>
</tr>
<tr>
<td>Labs developed by experts and objectives clearly defined</td>
<td></td>
</tr>
</tbody>
</table>
What I had to worry about?

**Validity**

<table>
<thead>
<tr>
<th>Instruments</th>
<th>If the tests are not valid then results are not justified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the Pre-Test and Post-test questions really testing what I wish to?</td>
<td>The tests were shown to domain experts</td>
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09-02-2013
What I had to worry about?

<table>
<thead>
<tr>
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<tr>
<td>Equivalence of the two tests</td>
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<tr>
<td>Is one test at a higher difficulty level than the other or both are at same level?</td>
</tr>
<tr>
<td>This was done by domain experts</td>
</tr>
<tr>
<td>If the tests are not equivalent then the claim that virtual labs help low performers more than high performers is false</td>
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</table>
Results
Analysis of Pre-test and Post-test Marks

Pre-test Post-test Marks - Sorted

Series 1- Pre-test Marks
Series 2- Post-test Marks

09-02-2013
Difference between Pre-test and Post-test Marks-all students

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error Mean</td>
<td>95% Confidence Interval of the Difference</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>pretestc – posttest cp</td>
<td>-2.51852</td>
<td>2.32899</td>
<td>.31693</td>
</tr>
</tbody>
</table>

- Sig(2-tailed) value is 0.000 which is less than 0.001
- There is a statistically difference between the pre-test and post-test scores
- Virtual labs are effective in developing the selected learning objectives
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<tr>
<td>Pair 2</td>
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There is a statistically significant difference between the Pre-test and Post-test marks of students with Low performance.

There is no statistically significant difference between the Pre-test and Post-test marks of students with high performance.

Virtual lab treatment helps students with low performance more than with high performance.
Did my idea really work?

The post-test score of students is higher than Pre-test score

Use Technology
Enhanced Learning
Virtual labs
Idea worked
Students understood the concepts
Students were able to make proper decisions regarding the use of constructs

Low performers Post-test scores are significantly higher than Pre-test scores
Thank You!
Acknowledgements

- MHRD NME-ICT Virtual labs project
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- All the participants of the workshop for the patient listening
References


