ISTE Workshop

Research Methods in Educational Technology

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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?

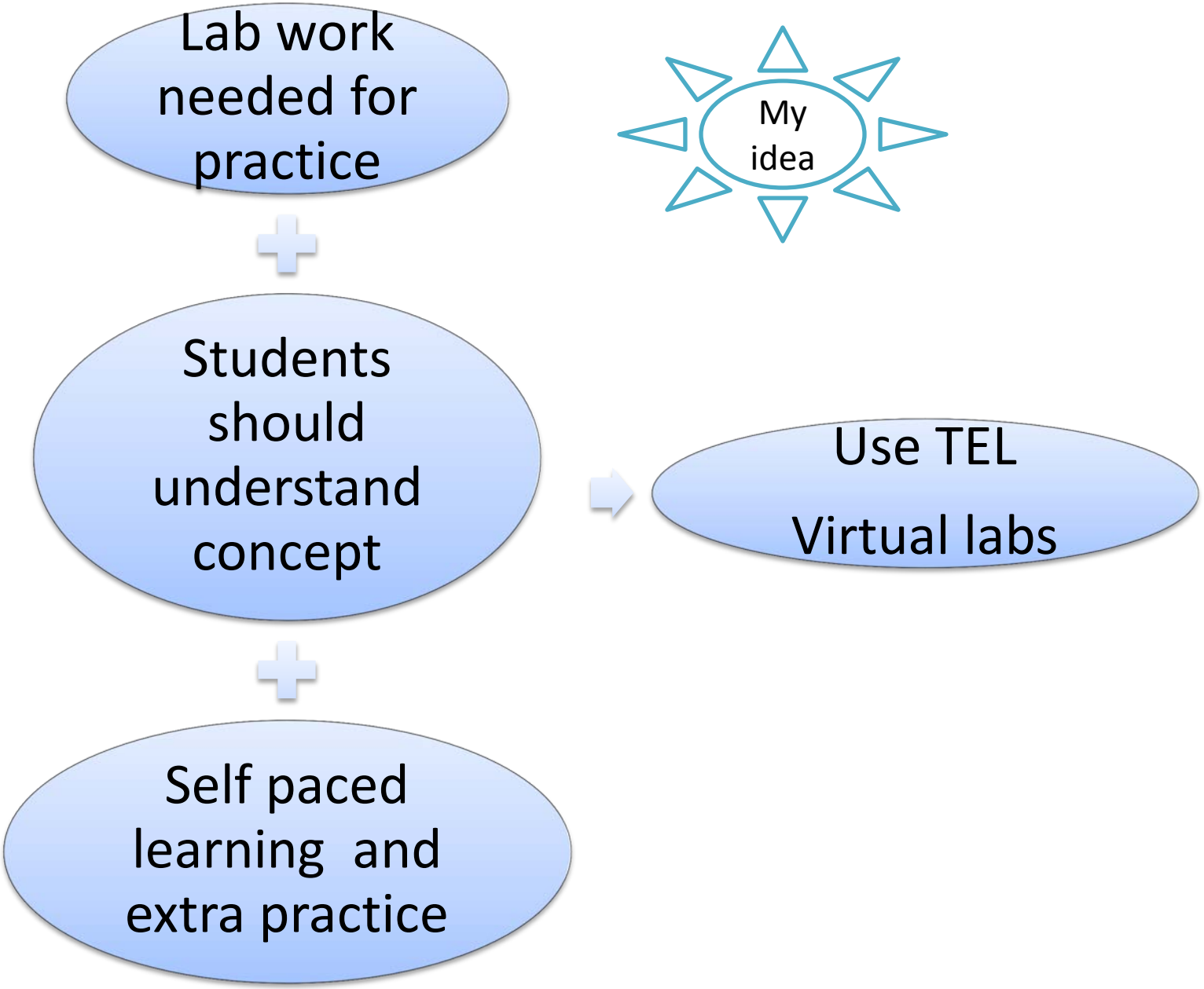
- In a programming course, some students are not able to
  - understand concepts in programming such as flow control, function calls, pointers
  - take decisions on the use of various constructs
- Some practice is obtained in labs, but not enough, especially for weak students
- Need instructional material 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
My idea
Students should understand concept
Use TEL
Virtual labs
Self paced learning and extra practice

VIRTUAL LABS

An Initiative of Ministry of Human Resource Development (MHRD)
Under the National Mission on Education through ICT

IIIT-H

COMPUTER PROGRAMMING LAB

Welcome to Computer Programming Lab


INTRODUCTION


LIST OF EXPERIMENTS


TARGET AUDIENCE


COURSES ALIGNED


PREREQUISITE S/W


FEEDBACK

Introduction

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?

What the students will do?

select the topic which the students find difficult to understand

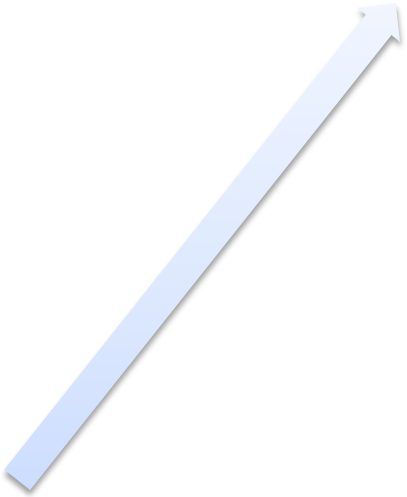
Find a virtual lab suitable for the topic

Check for the correctness of the lab

Find out if students are ready to work in the new technology labs

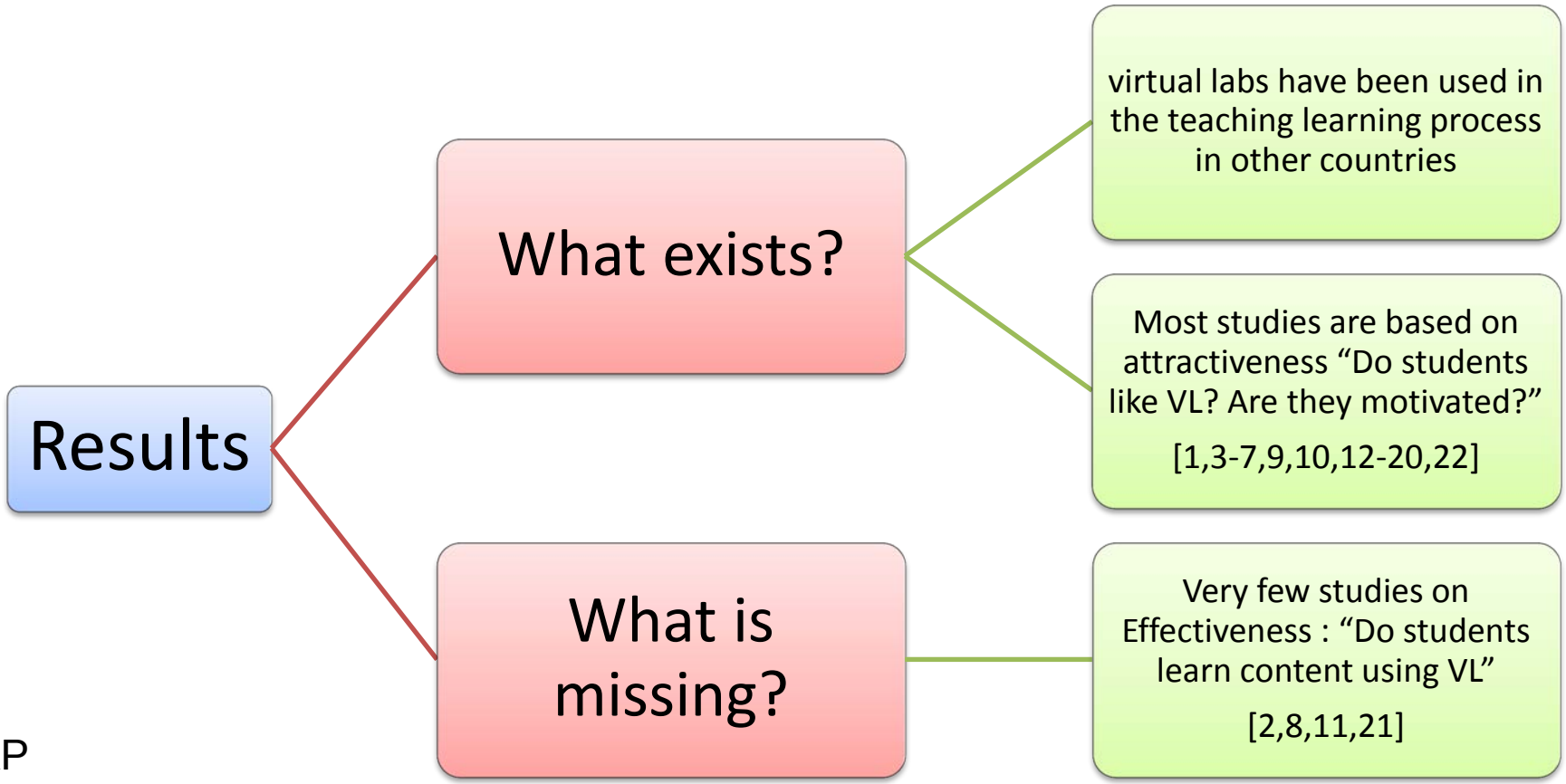
Design the study

Students will carry out experiments using the virtual lab



Positioning My Work

Comprehensive literature survey carried out



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

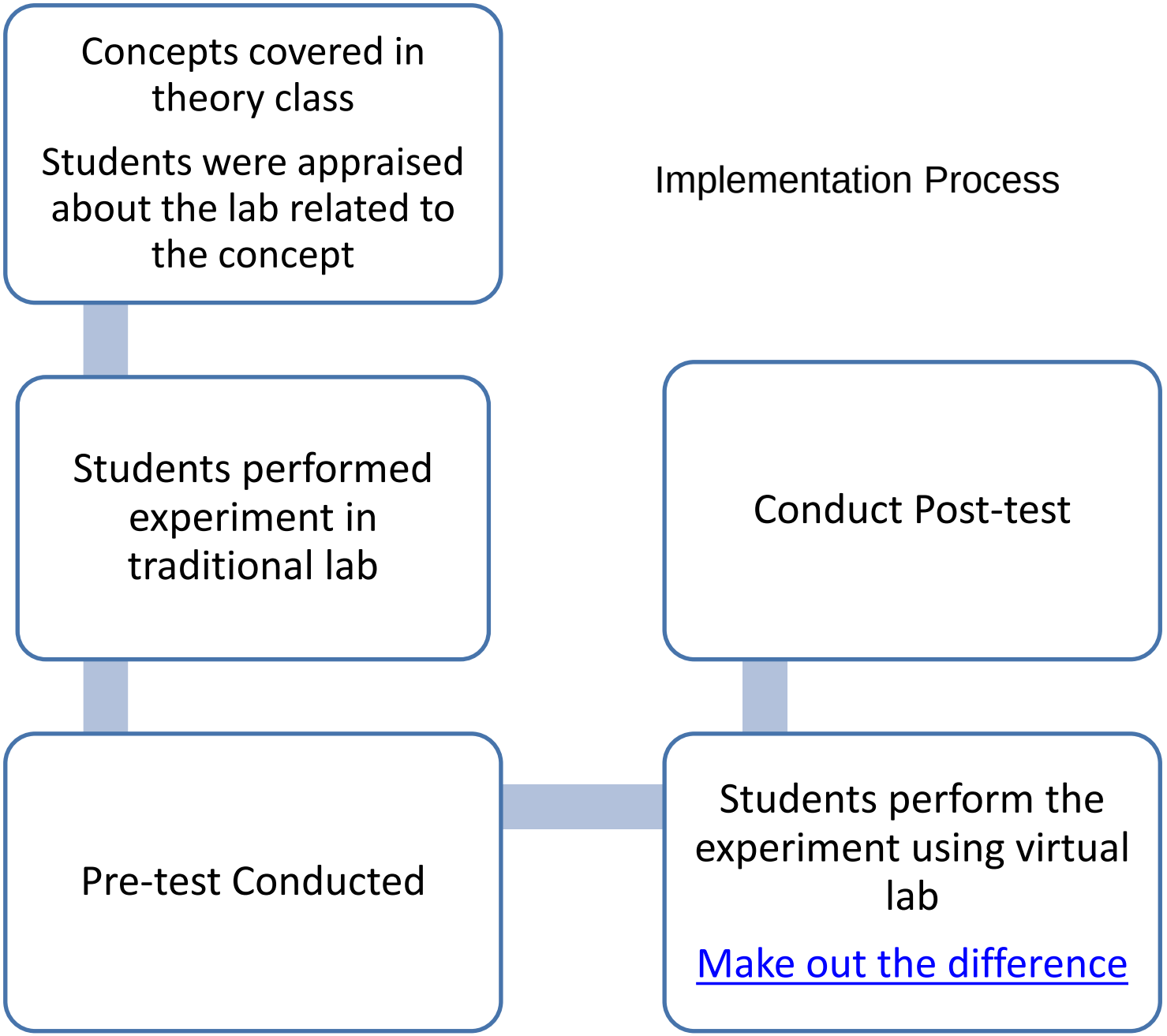
- To learn how decision making is done while programming.
- To learn about the various simple constructs used for control flow. (for loop, if, else if, switch case etc)
- To learn about the various advanced constructs used for control flow in order to achieve repetition of instructions.(nested if, while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

Details of experiment/study

- Virtual lab selected VL1 :http://**deploy.virtual-abs.ac.in/labs/cse02/index.php**
- **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

  O1 X O2
- **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

Implementation Process



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?

Pre-test Marks

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

Post-test Marks

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

Statistic used

- 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

Content

Am I really using the labs matching my objectives?

Labs developed by experts and objectives clearly defined

If not valid then results are not acceptable

What I had to worry about?

Validity

Instruments

Are the Pre-Test and Post-test questions really testing what I wish to?

The tests were shown to domain experts

If the tests are not valid then results are not justified

What I had to worry about?

Validity

Equivalence of the two tests

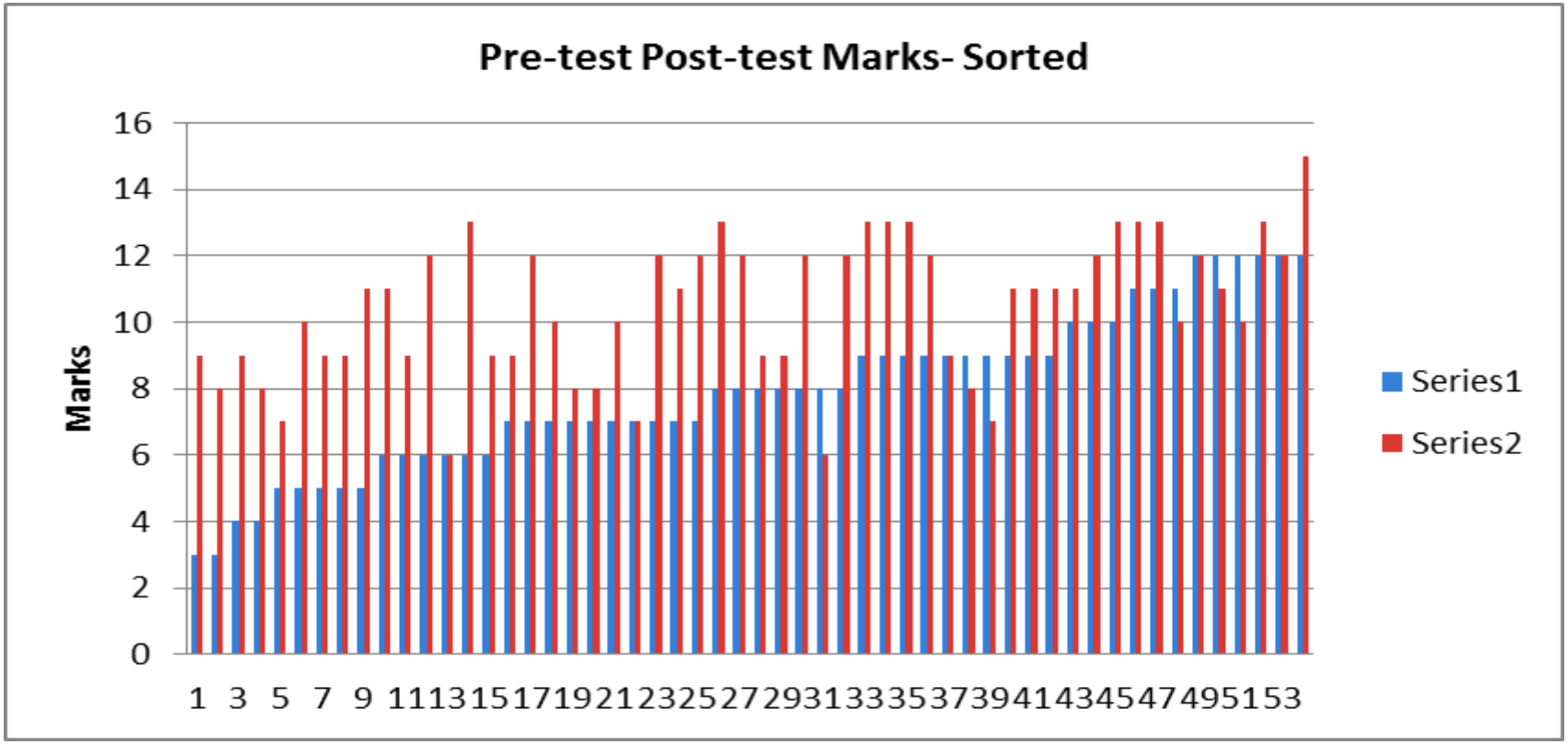
Is one test at a higher difficulty level than the other or both are at same level?

This was done by domain experts

If the tests are not equivalent then the claim that virtual labs help low performers more than high performers is false

Results

Analysis of Pre-test and Post-test Marks



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

Difference between Pre-test and Post-test Marks-all students

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretestcp – posttestcp	-2.51852	2.32899	.31693	-3.15421	-1.88283	-7.946	53	.000

- 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**

Difference between Pre-test and Post-test marks of students with Low and High Performance

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	lowpre – highpre	-3.52000	.87178	.17436	-3.87985	-3.16015	-20.189	24	.000
Pair 2	lowpost – highpost	-1.48000	2.97377	.59475	-2.70751	-.25249	-2.488	24	.020

There is a statistically significant difference between the Pre-test and Post-test marks of students with Low performance

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

Virtual lab treatment helps students with low perform more than with high performance.

Did my idea really work?

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

Low performers Post-test scores are significantly higher than Pre-test scores

Use Technology Enhanced Learning

Virtual labs

Idea worked

Students understood the concepts

Students were able to make proper decisions regarding the use of constructs

Thank You!

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