

A large portion of the left side of the slide features a photograph of a modern building's facade. The facade is composed of numerous small, triangular panels arranged in a grid-like pattern. The colors of these panels vary, creating a vibrant, geometric texture. The building is set against a clear blue sky with a few wispy clouds.

**UK RASCH User Group 2017**

**An Empirical Investigation of the Effectiveness of  
eLearning Strategies in Higher Education:  
A Rasch-Model for Saudi Arabia**

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# Background

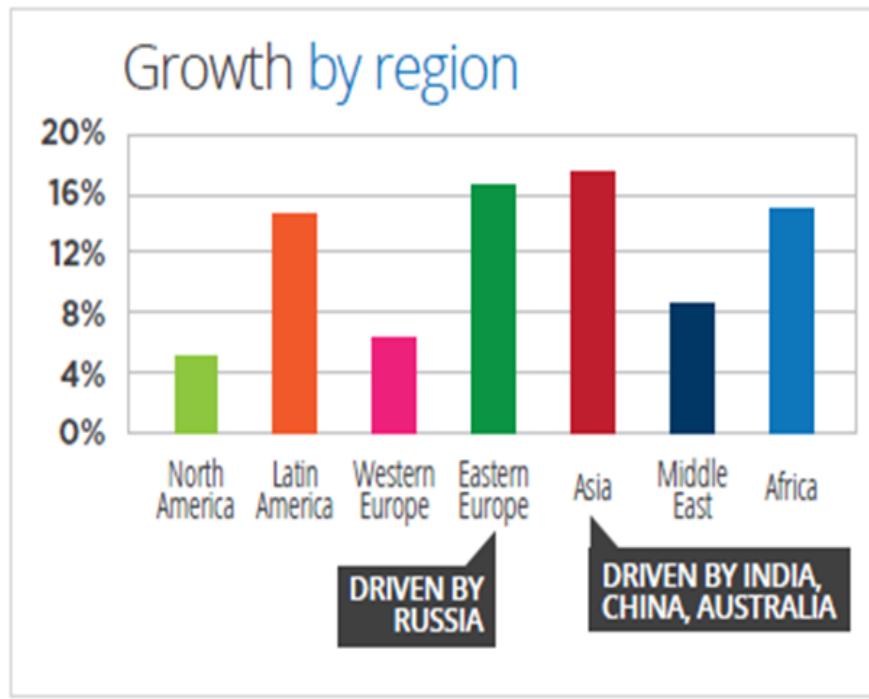


Figure 1: 2011-2016 Global Growth Rates of E-Learning Market (Ambient Insight 2012)

High-impact effective eLearning applications in higher education are **rarely** reported (Allen, 2016).

# Main Research Question

**What are the interactive effects of instructional delivery modes and individual's cognitive preferences on learners' performance?**

## Research Aim

Improving the instructional design (ID) of the pedagogical environment for eLearning the in higher education (HE) institutions.

- Provide a set of IS-design specifications and guidelines to the effective application of eLearning technologies within the HE sector.
- Develop a framework, which defines and guides the best ePedagogical practices.

# Research Design

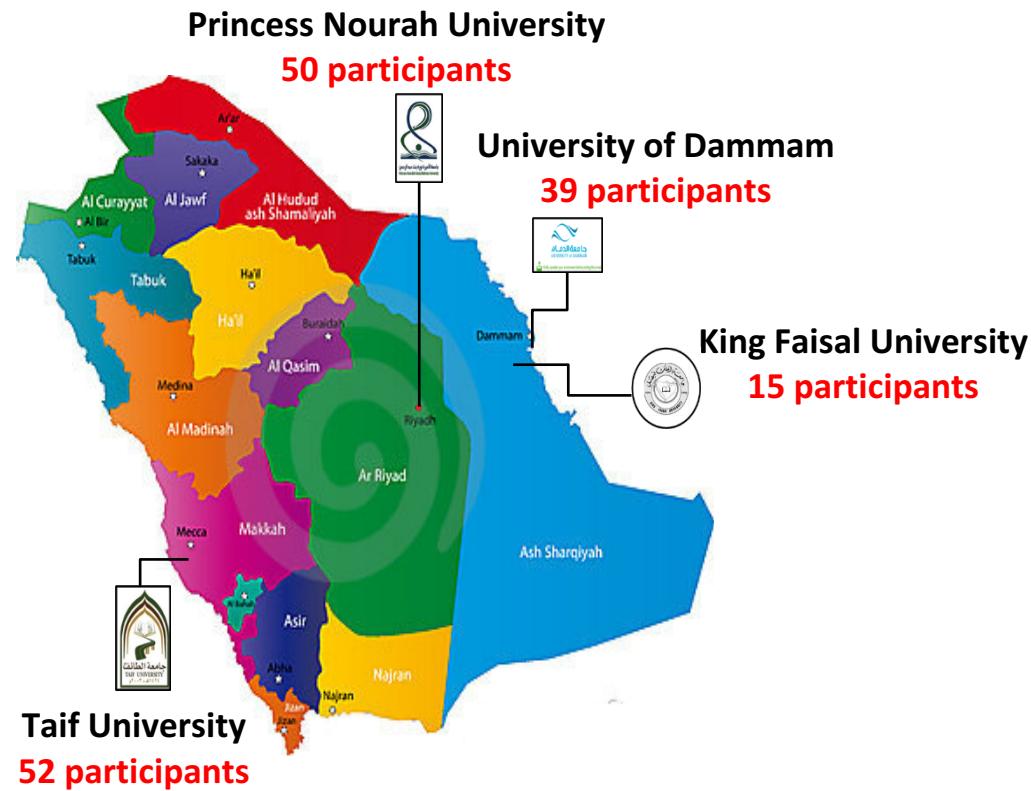
- A series of **quasi-experiments** (pre-test-post-test comparison group).
- **2x3 factorial** design.

Cognitive style measure	Instructional delivery mode		
	Conventional F-to-F	Computerised	Blended (F-to-F and Computerised)
Verbal	Group 1	Group 2	Group 3
Imagery	Group 4	Group 5	Group 6

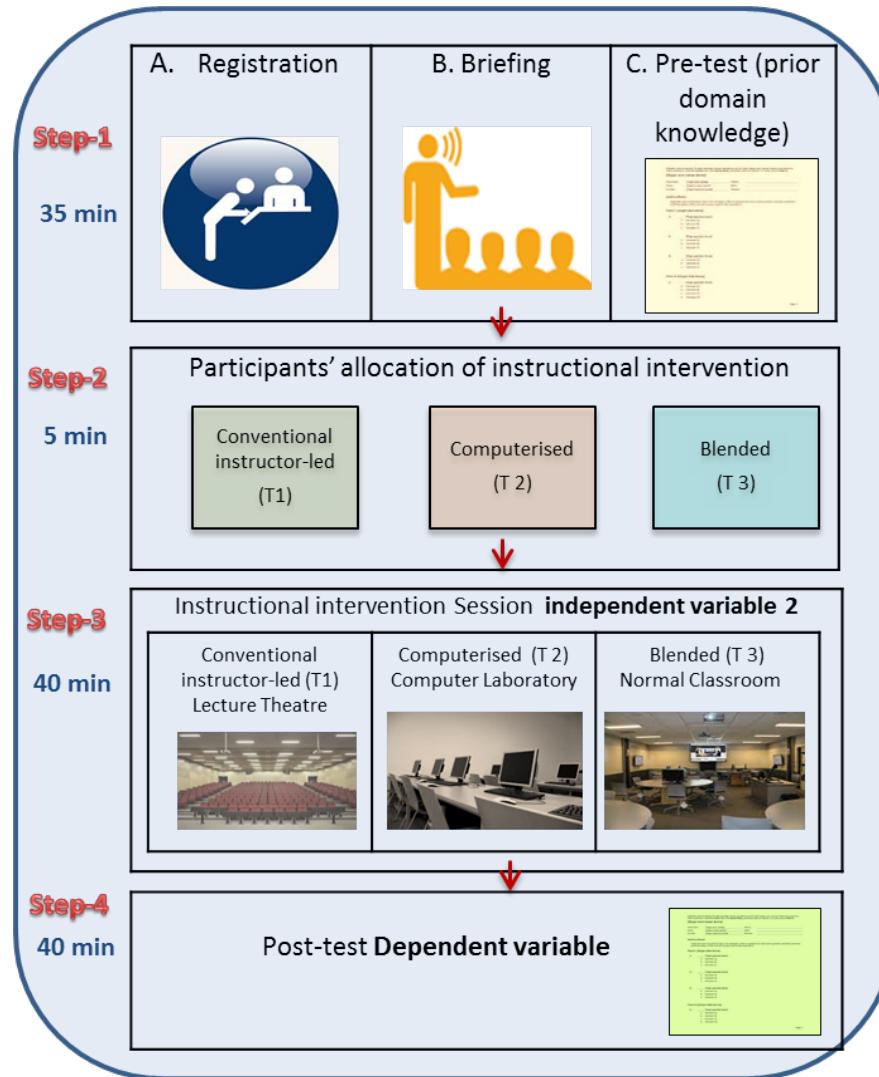
# Research Methodology

Pre-validation study: 11 participants

Participants and context: 167 undergraduates volunteered

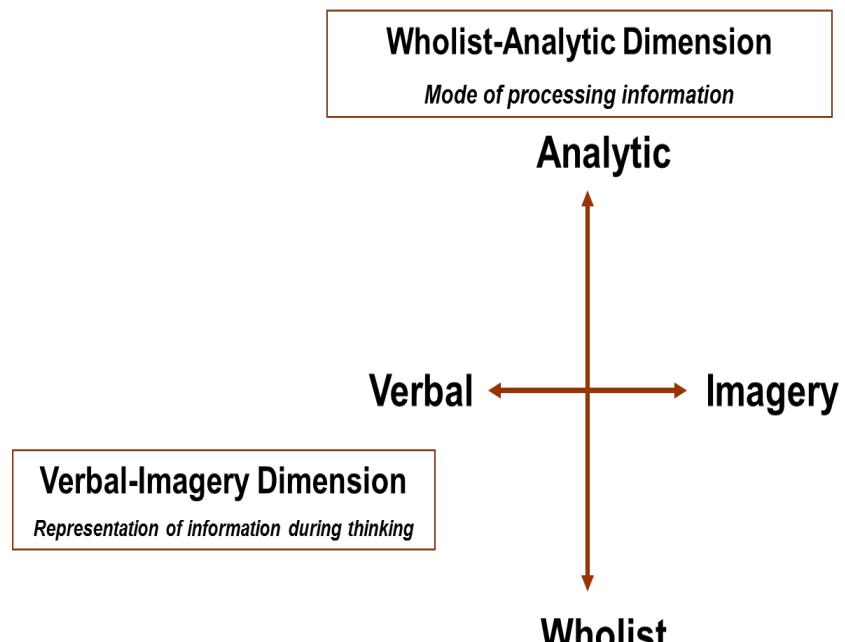


# Experimental Procedure

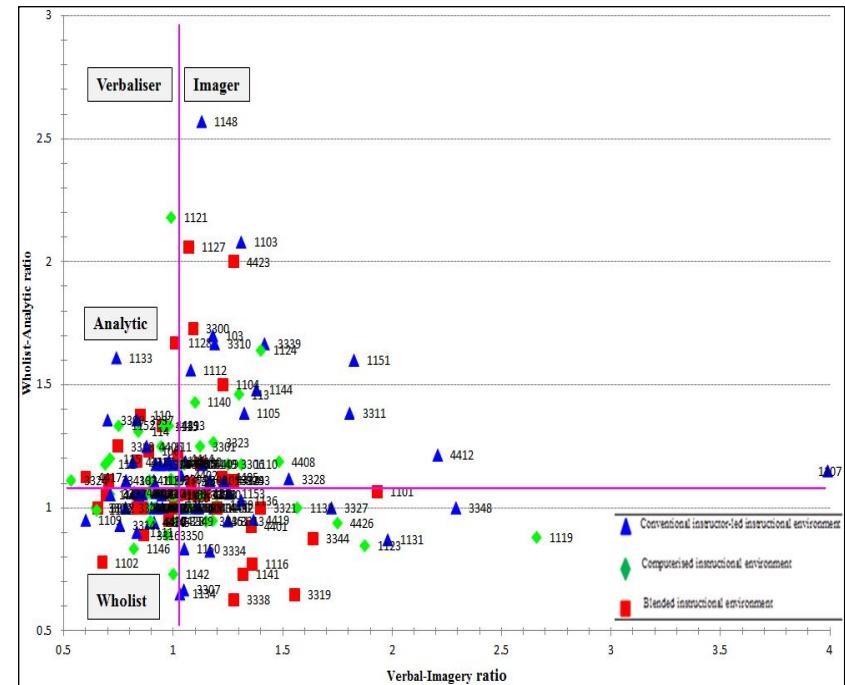


# Study Instruments-prior to experiments

## The cognitive style analysis test (CSA)



Cognitive style (Riding & Cheema, 1991)

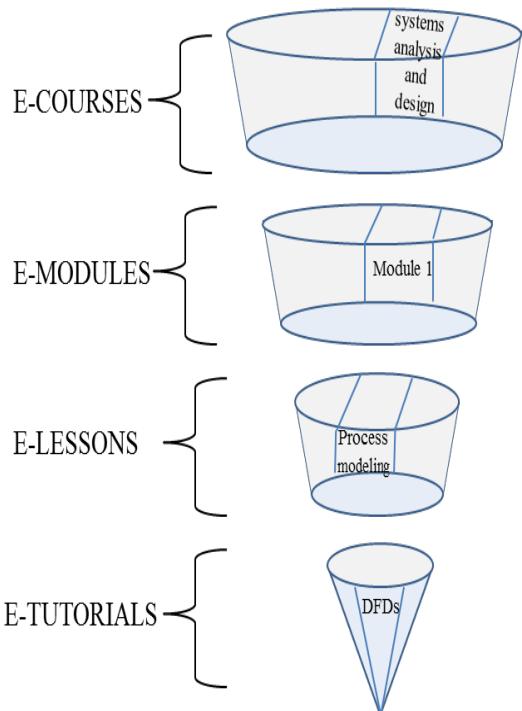


Allocation of instructional treatment

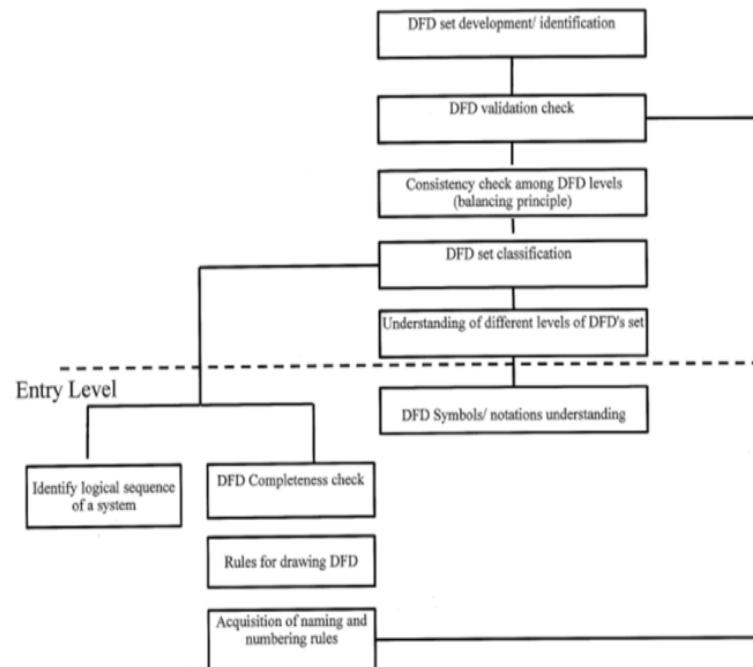
# Study Instruments- during the design and development phase

## Instructional materials

- The design of the Information Systems Analysis and Design (ISAD) course
- Task analysis
- Lesson plan



Application of Reigeluth's (1983) elaboration structure



The lesson's hierachical task analysis

Nine events of instruction Gagné (1985)

1. Gain attention of the learner
2. Inform students of the objectives
3. Stimulate recall of prior learning
4. Present the content
5. Provide learning guidance
6. Elicit performance (practice)
7. Provide feedback
8. Assess performance
9. Enhance retention and transfer to the job

# Study Instruments-during the design and development phase

## Learning Measures and Cognitive Performance Assessment Instrumentation

- A skill development matrix
- The pre-and-post-tests

Table 2: Specification skill development matrix (McKay, 2000)

		Instructional Objectives: DFD set development							
		Declarative		Procedural		Meta-cognitive			
		Band-A	Band-B	Band-C	Band-D	Band-E	Band-F		
Verbal information skill	Intellectual skill	Basic rule	Higher order rule	Cognitive strategy	Cognitive strategy	Meta-cognitive knowledge			
Concrete concept	Discriminates concepts & principles	Understands concepts & principles	Problemsolving	Identify subtasks	Recognises unstated assumptions	Strategic or reflective knowledge			
Knows basic terms			Applies concepts & principles to new situations			Recall simple prerequisite rules & concepts			
Knows 'that'						Integrates learning from different areas into a plan for solving a problem			
Task No:	Learning Domain:						Totals:	Task difficulty	
5	DFD set development				DICH PC	DICH PC		Difficult	
4	DFD validation check			DICH PC	DICH PC			Medium-to-difficult	
3	DFD set classification		DICH PC	DICH PC				Medium	
2	Understanding of different levels of DFD's set	DICH PC	DICH PC					Easy-to-medium	
1	DFD Symbols/notations understanding	DICH PC	DICH PC					Easy	
	Totals:								

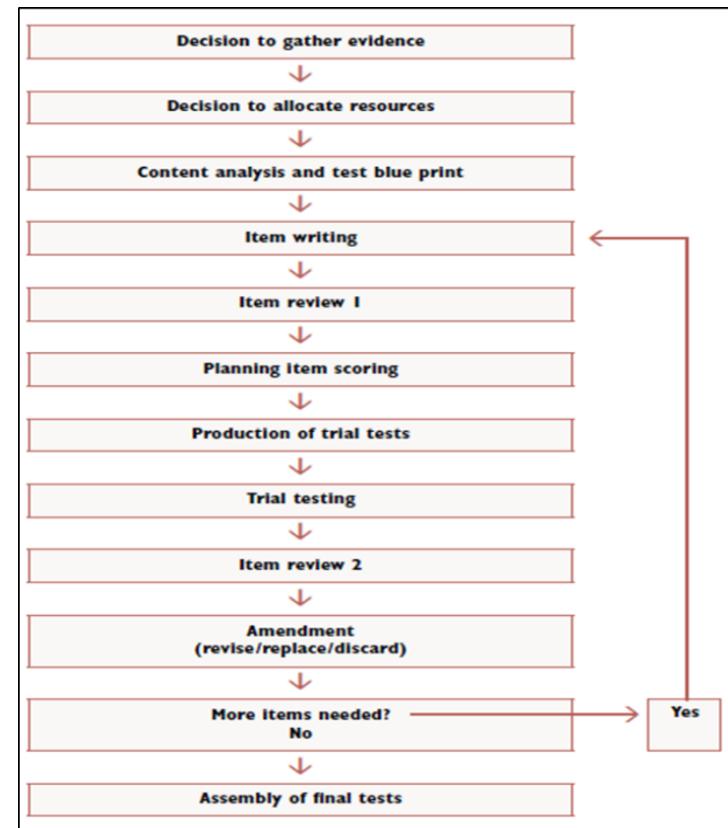
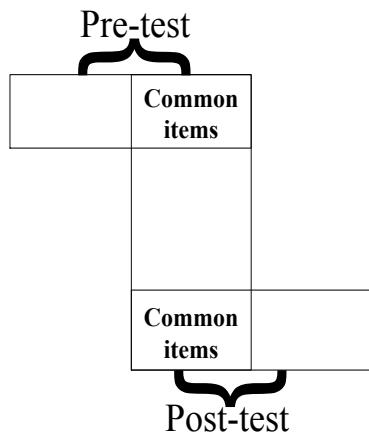


Figure 6: Stages in test construction (source: Ross, 2005)

# Study Instruments-during the design and development phase

- Common items-linking
- Scoring techniques

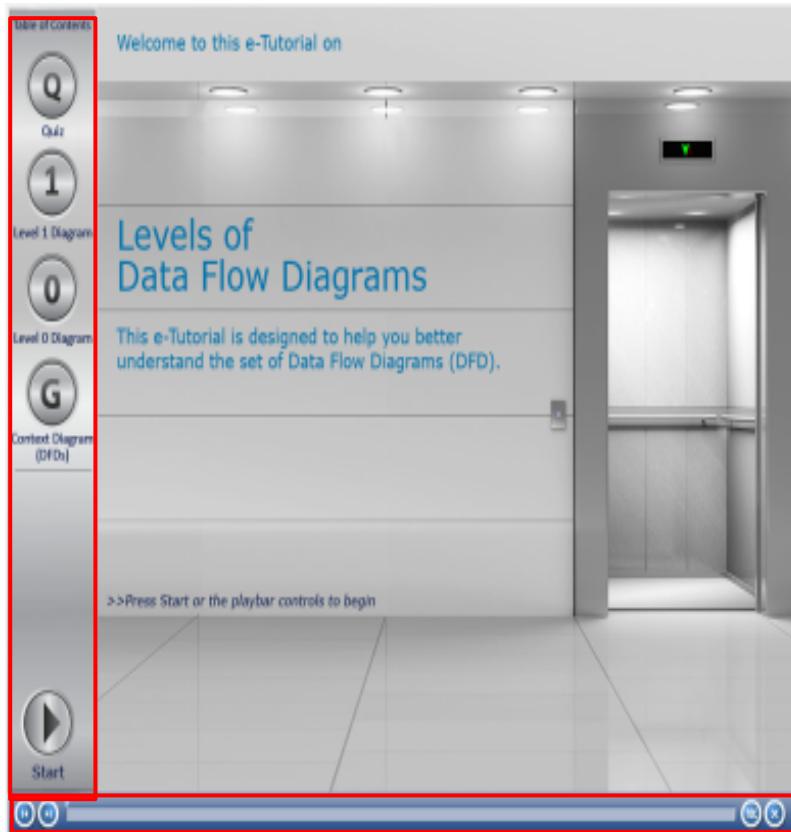


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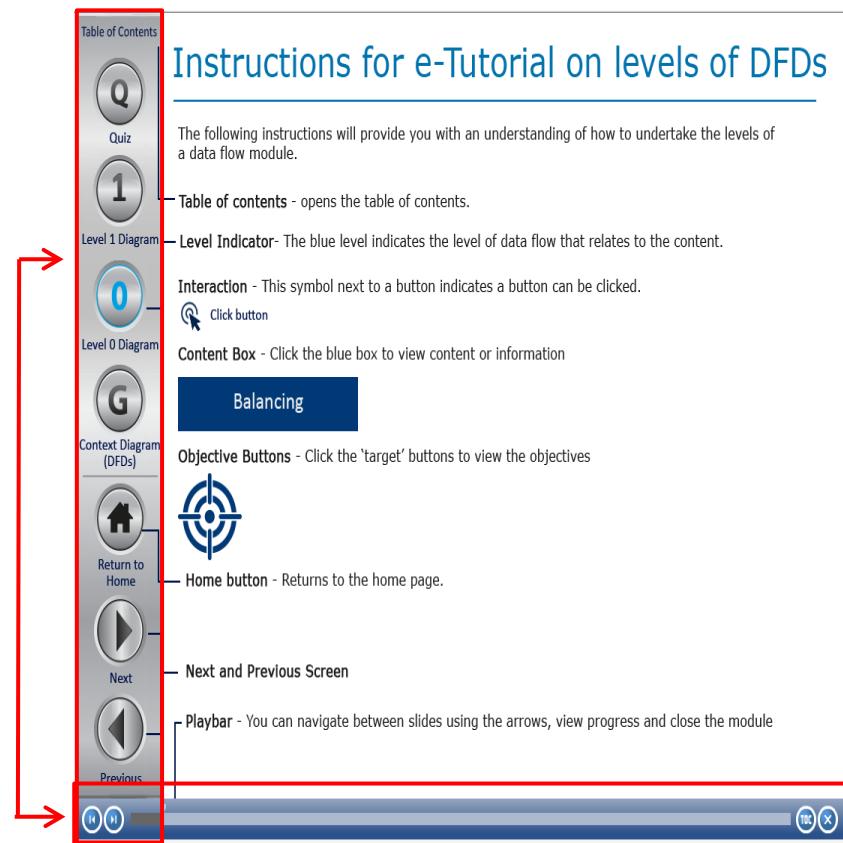
# Study Instruments-during the development phase

- The Design of the eTutorial Module

Analytics



Wholists



# Study Instruments-during the development phase

Verbalisers

Balanced DFDs

Some of the important rules to be followed when drawing DFDs include:

**Balancing** Click button  
Balancing means maintain the same number of inputs and outputs on a higher level DFD on the lower level DFD that decomposes it.

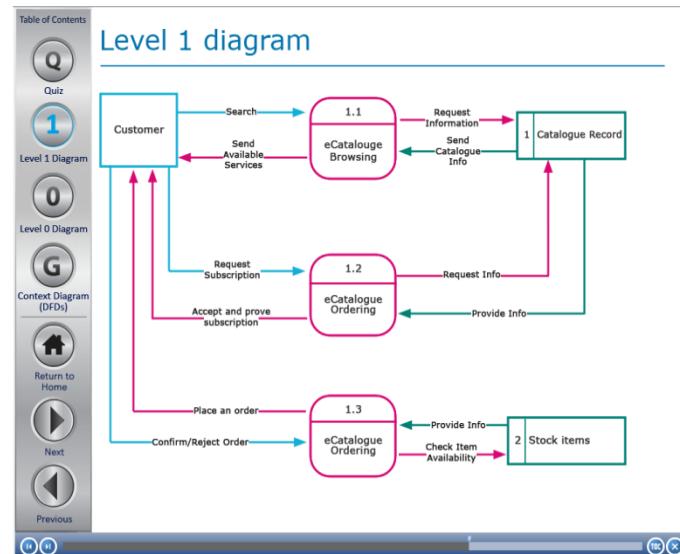
**Completeness** Click button  
A complete DFD includes all necessary components for a system.

**Example** Click button

Context Diagram: 0 Input, 3 Outputs

Level 0 Diagram: 1 Input, 1 Output; 1.0 Input, 1 Output; 2.0 Input, 1 Output

Level 1 Diagram: 1 Input, 3 Outputs



Imagers

Check your knowledge

Now after covering the core concepts of this lesson, try to apply your knowledge by taking this quiz.

The quiz has 4 types of questions: true/false, multiple choice, fill in the blanks, and scenario-based questions.

For each question, use your mouse to click on the right answer; then click on Submit to see whether you were correct or not, and to go to the next question.

Please note that your Quiz results are NOT captured or recorded anywhere. Click on the Home page to review parts of the Module and Retry quiz to try the quiz again.

To start this Quiz, click on the NEXT button below.

# Preliminary Data Analysis

Establishing the validity of test-items (fit maps)

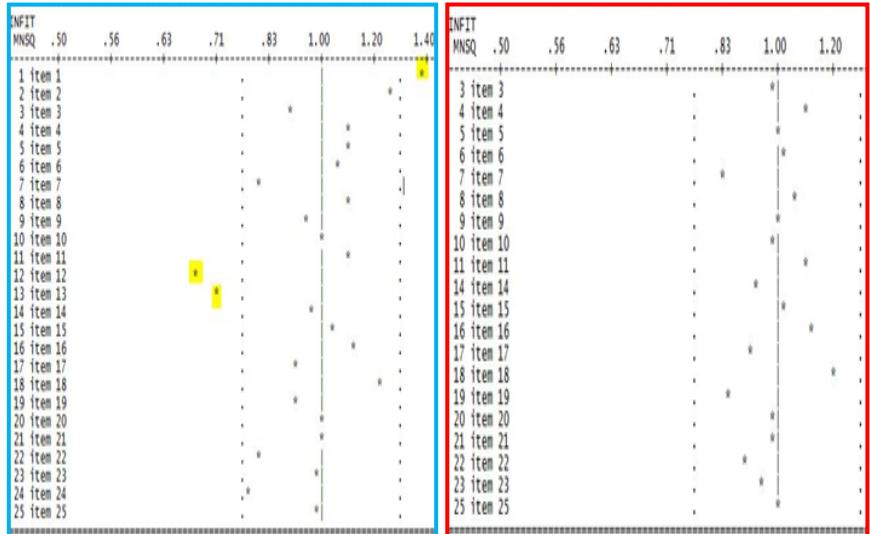
Pre-test



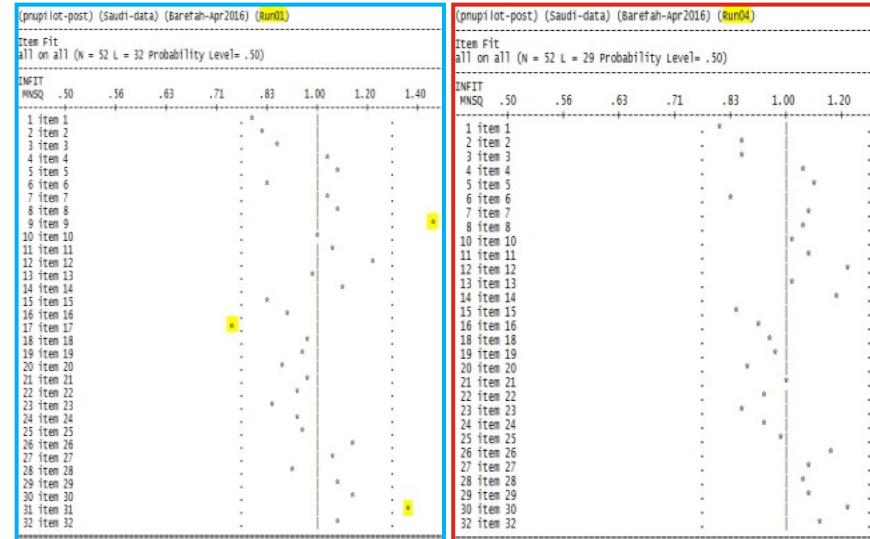
Post-test



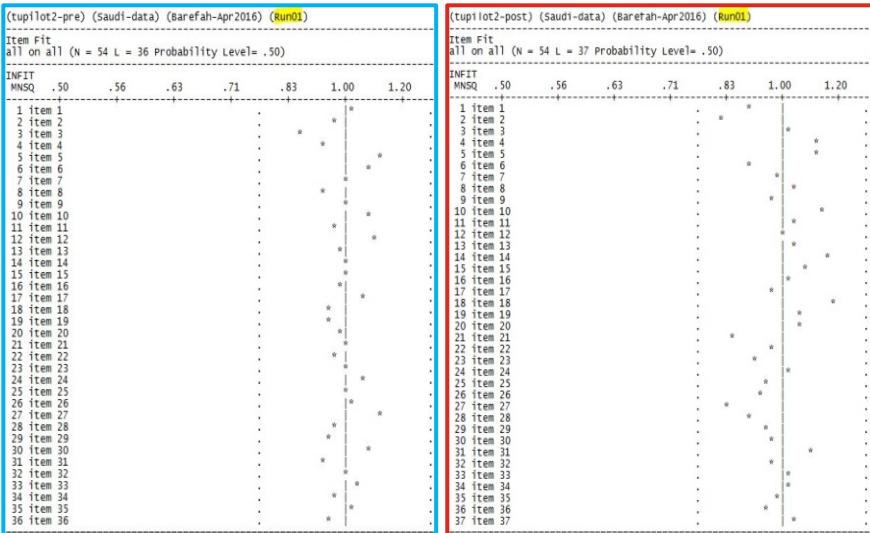
## Validation study I (Pilot-1)



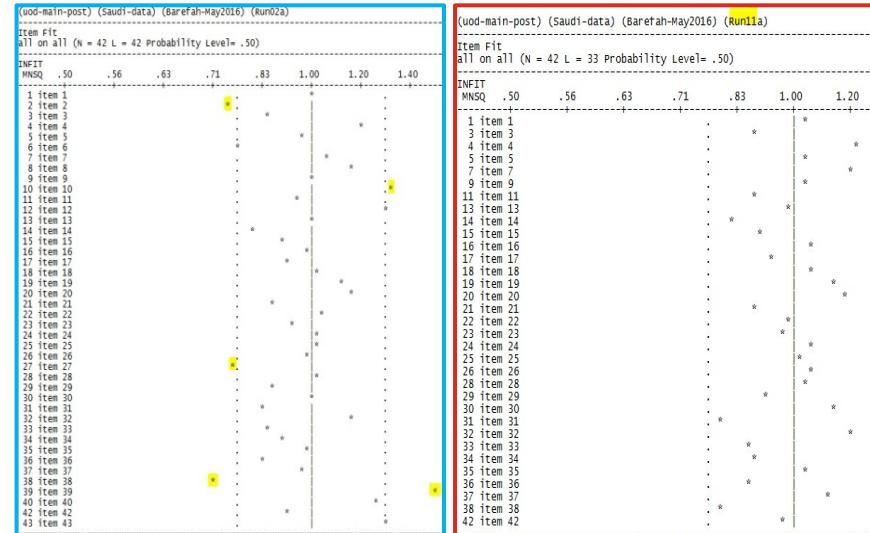
## Validation study II (Pilot-2)



## Validation study III (Pilot-3)



## Main study



# Item analysis table

Item Analysis Results for Observed Responses all on all (N = 54 L = 32 Probability Level= .50)				
.....				
Item	1: item 1		Infit MNSQ = .85	Disc = .54
Categories	0	1	2	missing
Count	31	23	0	0
Percent (%)	57.4	42.6	.0	
Pt-Biserial	-.53	.53	NA	
p-value	.000	.000	NA	
Mean Ability	-.68	.08	NA	NA
Step Labels		1		
Thresholds		-.05		
Error		.29		
.....				
Item	2: item 2		Infit MNSQ = .79	Disc = .62
Categories	0	1	2	missing
Count	39	15	0	0
Percent (%)	72.2	27.8	.0	
Pt-Biserial	-.62	.62	NA	
p-value	.000	.000	NA	
Mean Ability	-.63	.35	NA	NA
Step Labels		1		
Thresholds		.67		
Error		.32		
.....				
Item	3: item 3		Infit MNSQ = 1.03	Disc = .28
Categories	0	1	2	missing
Count	30	24	0	0
Percent (%)	55.6	44.4	.0	
Pt-Biserial	-.28	.28	NA	
p-value	.020	.020	NA	
Mean Ability	-.54	-.13	NA	NA
Step Labels		1		
Thresholds		-.13		
Error		.29		
.....				
Mean test score	33.34			
Standard deviation	8.73			
Internal Consistency	.88			

## Key Finding

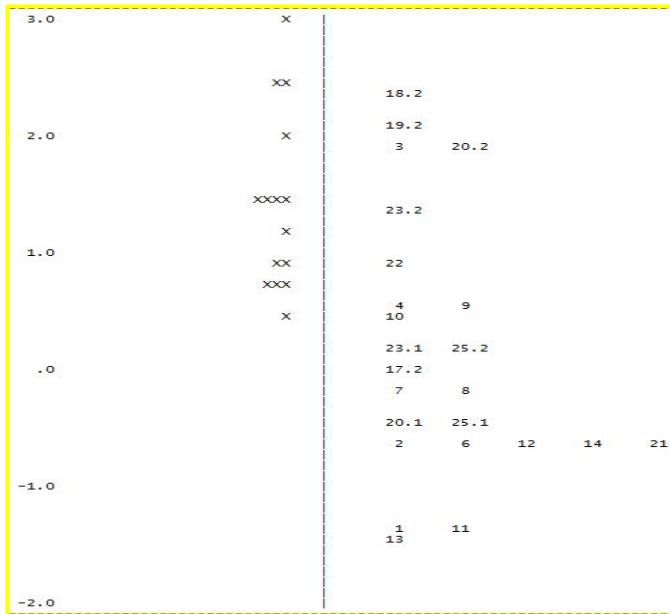
All test-items are **valid** and **reliable** for further analysis

The individual item statistics are calculated using all available data.

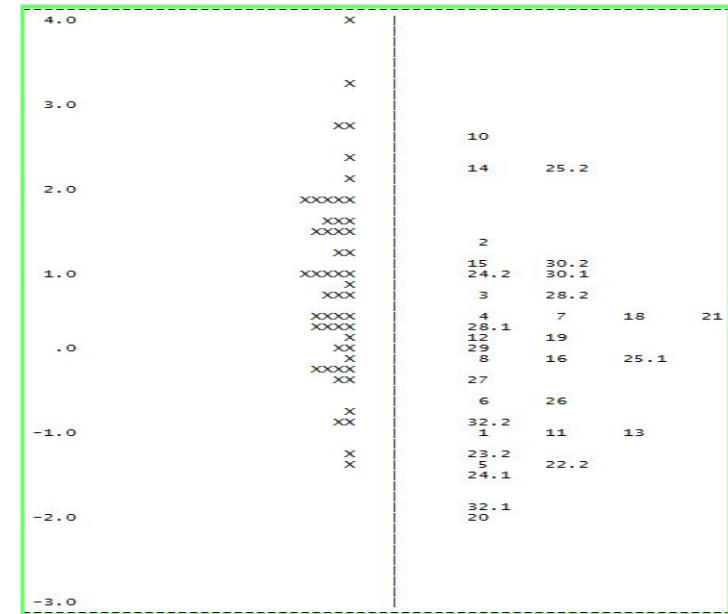
The overall mean, standard deviation and internal consistency indices assume that missing responses are incorrect. They should only be considered useful when there is a limited amount of missing data.

# Initial performance analysis (variable maps (post-tests))

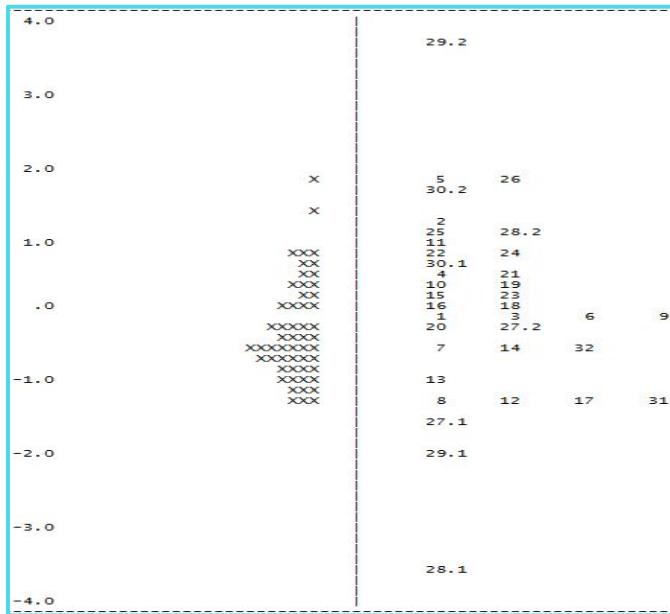
(Pilot-1)



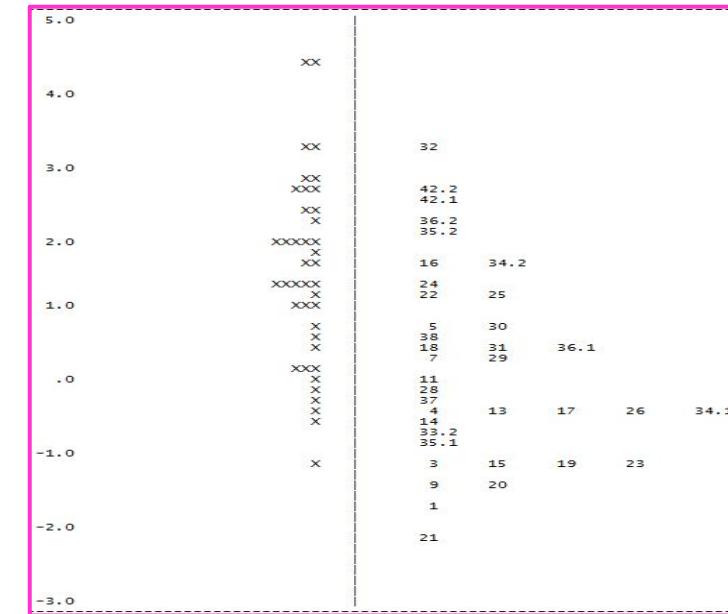
(Pilot-2)



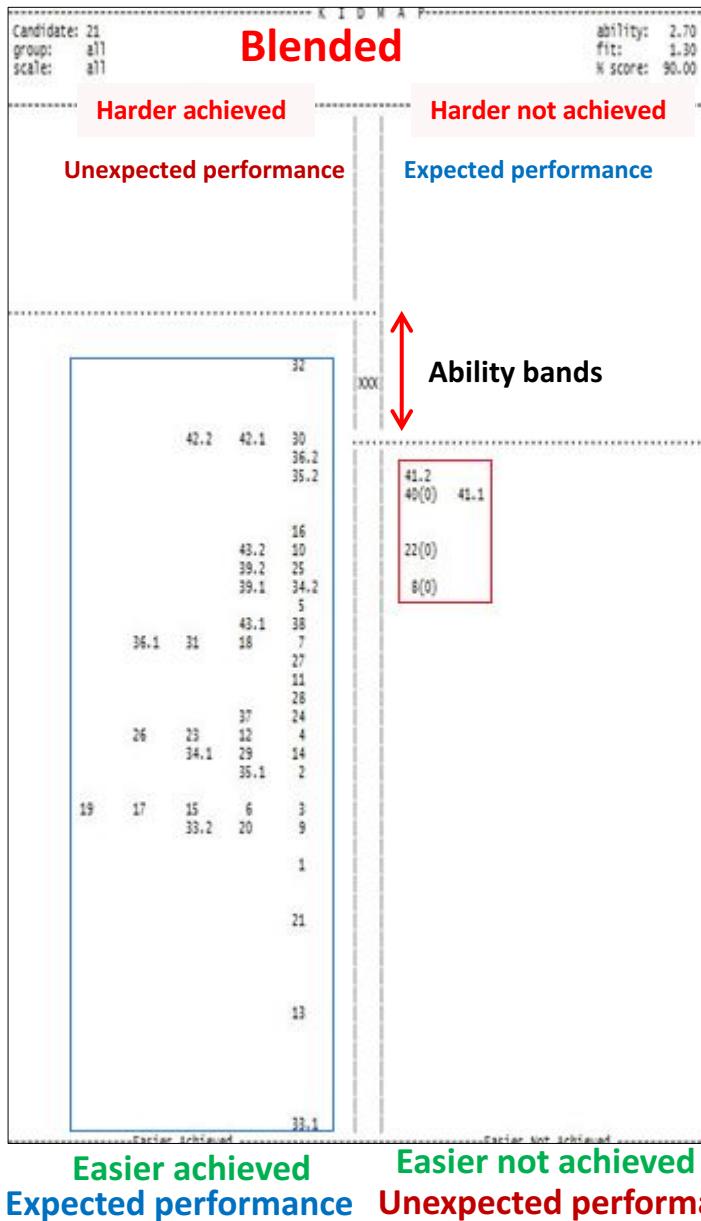
(Pilot-3)



(Main)



# Tasks Difficulty and performance (kid-maps)



## Key Findings

- ❖ All three instructional course delivery modes facilitate the acquisition of **Declarative knowledge**
- ❖ **Computerised** environment facilitates the knowledge required to answer tasks with medium-difficulty level
- ❖ The **blended** environment is the most effective delivery modes that enables the acquisition of **procedural knowledge**

# **Research Contribution**

## **Theoretical**

Resolve some of the inconsistencies regarding the evaluation of the effectiveness of ICT-based instruction in HE environments

## **Practical**

Provide the instructional design community with a validated IS-design model and instruments for designing with ICT tools.

## **Institutional**

Inform HE policy makers/ service providers with insights regarding the effective ePedagogical practices to customise the learning experience and reach a wider learner-base

# Thank you

## Reference List

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