Investigation of the Effectiveness of Different Teaching Tools

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Teaching Tools for Classroom Lectures

1. diagrams
2. models
3. worked examples
4. short video clips
5. 3D computer animations
6. wrong "learn from mistakes" examples
7. small group discussion
8. student presentation
9. role play

Objectives

- Ultimate objective: to measure the effectiveness of the six different teaching tools.

- Specific objectives:

  (a) understand how student learn abstract theories/concepts, and

  (b) improve instructors teaching performance by using effective teaching tools.
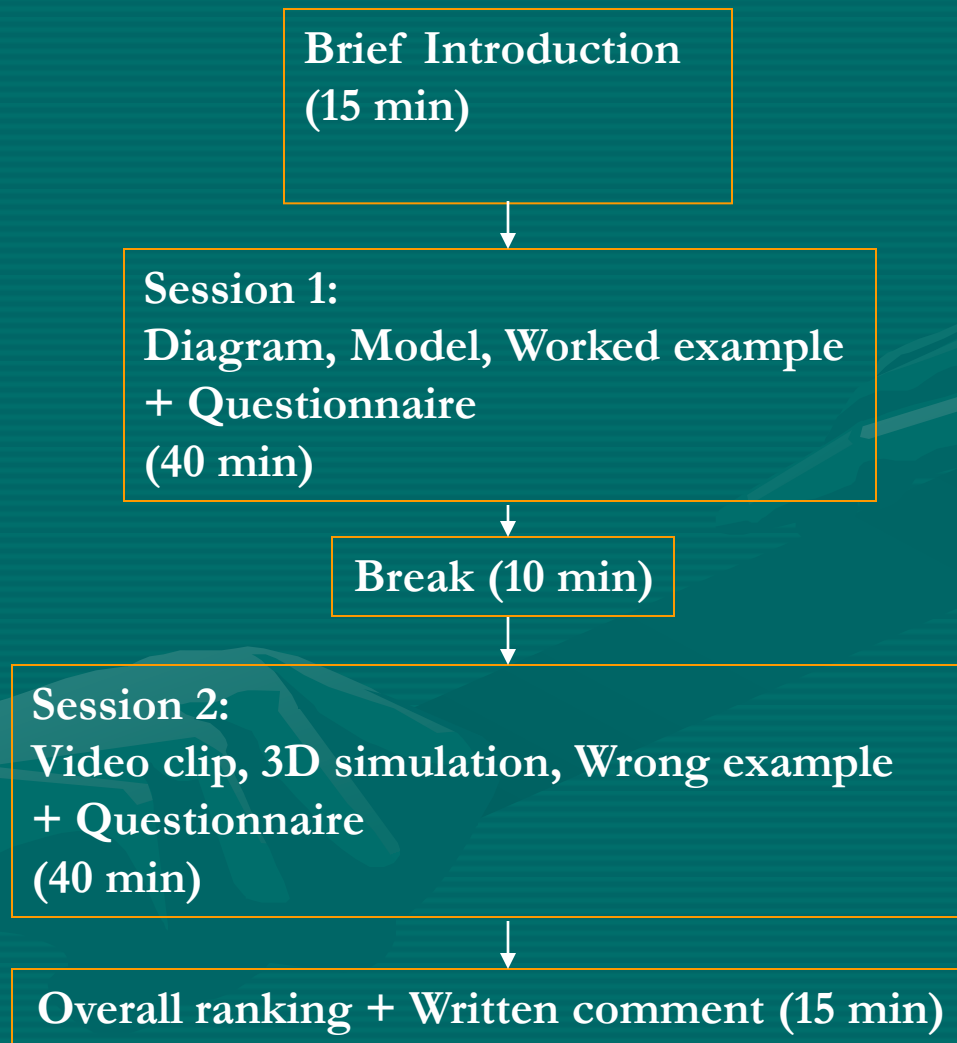
Definition

- *An effective teaching tool for a classroom lecture is defined as (i) understanding of lecture material and (ii) stimulating student interest in learning.*

Methodology

An experimental classroom lecture, conducted on 8 March 2004, was carried out in three phases:

(1) Delivering classroom material by using each of the six teaching tools.

(2) Conducting a survey after each session.

(3) Analyzing the survey results and comparing the effectiveness of each tool.

Procedures of the 120-minute Experimental Classroom Lecture

Brief Introduction (15 min)

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Session 1:
Diagram, Model, Worked example + Questionnaire (40 min)

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Break (10 min)

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Session 2:
Video clip, 3D simulation, Wrong example + Questionnaire (40 min)

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Overall ranking + Written comment (15 min)

Quality Control of Experimental Setup

- All first-year students

- Significant numbers of sampling points (class size of 93).

- Six teaching tools were used to deliver six different technical concepts/theories, but each concept/theory was carefully chosen to have a similar level of difficulty.

- Same instructor.

Questionnaire

Five questions regarding each teaching tool were asked:

(Q1) The level of difficulty of this part of lecture material;

(Q2) The ability of this teaching tool to illustrate the concept/theory clearly and to help the students to understand the lecture material;

(Q3) The ability of this teaching tool to stimulate the student's interest in learning the lecture material;

(Q4) A technical question on the concept;

(Q5) The effectiveness of this teaching tool in classroom lecture.

Q1

Not difficult				Average				Very difficult
1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
○	○	○	○	○	○	○	○	○

Q2 & Q3

Strongly disagree				Neutral				Strongly agree
1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
○	○	○	○	○	○	○	○	○

Q5

Not effective				Average				Very effective
1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
○	○	○	○	○	○	○	○	○

Brief Introduction Given in the Experimental Classroom Lecture

Diagrams

Models

Worked Examples

Video Clips

3D Simulations

Wrong Examples

Results and Discussion

Statistic Findings of the Six Teaching Tools

	Level of Difficulty (Q1)		Illustrating Concepts Clearly (Q2)		Stimulating Interest (Q3)		Individual Effectiveness (Q5)		Overall Effectiveness	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Diagrams	2.7	0.7	3.6	0.7	3.1	0.7	3.4	0.7	2.8	1.4
Models	3.2	0.8	4.0	0.8	3.8	0.7	3.8	0.7	2.0	1.2
Worked Examples	2.0	0.9	3.5	0.7	2.8	0.9	3.4	0.8	3.1	1.5
Video Clips	2.6	0.8	3.4	0.8	2.7	0.8	2.8	0.8	4.7	1.1
Simulations	3.3	0.6	3.1	0.7	3.4	0.8	3.5	0.7	3.5	1.5
Wrong Examples	4.2	0.7	2.7	0.9	2.7	1.0	2.8	1.0	4.9	1.5

Note:

1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
○	○	○	○	○	○	○	○	○

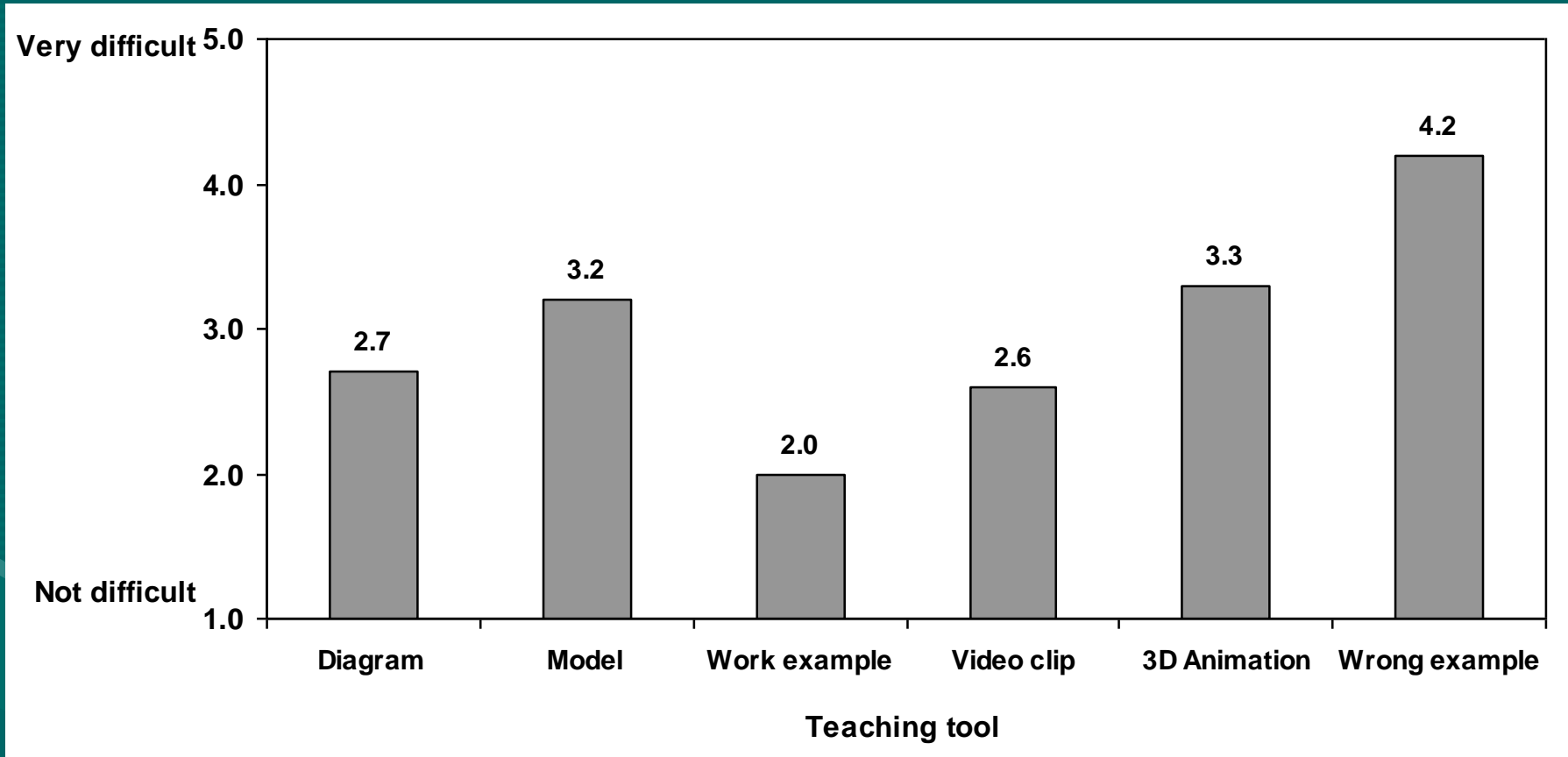# Results and Discussion- cont.

Figure 1: Level of difficulties of lecture materials delivered by the six teaching tools
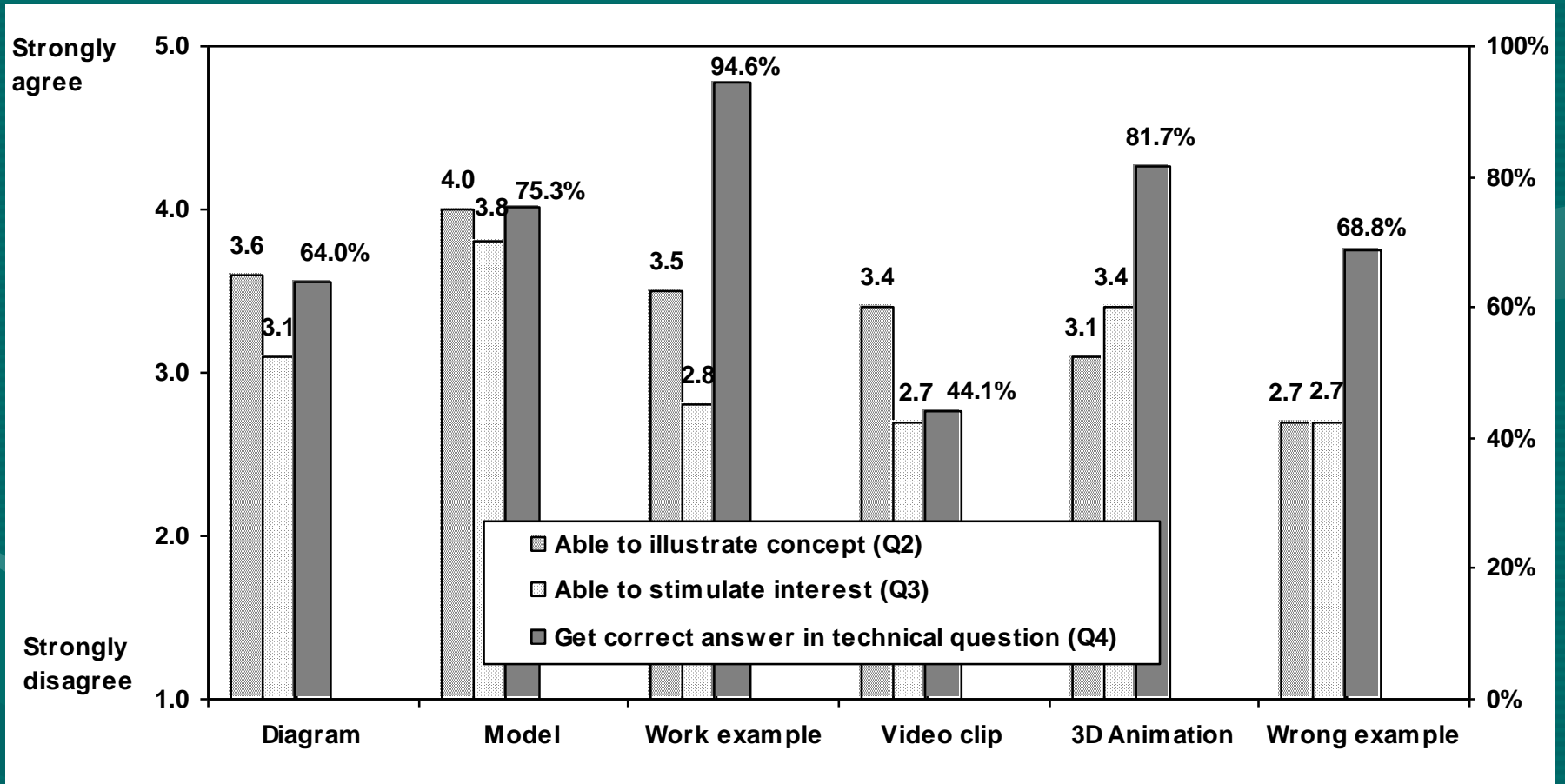
Results and Discussion- cont.

Figure 2. Usefulness of the six teaching tools in terms of illustrating a concept and stimulating student's learning

Results and Discussion- cont.

- The first three conventional teaching tools (diagram, model and worked example) were generally regarded as methods that were able to illustrate a concept.

- The model was considered as the most effective method to illustrate a concept as well as to stimulate a student's interest.

- Using a wrong example for teaching a concept/theory was not considered as an effective tool compared with the other five methods.

Results and Discussion- cont.

- The lowest score for wrong example is perhaps due to the limited time allocated to this method so that students were not be able to identify what was the true theory and finally felt confused by the theory.

Results and Discussion- cont.

- Visualization methods such as video clips and 3D simulations have similar scores to those of diagrams and worked examples.

- Video clip was able to illustrate a concept (mean = 3.4 on Q2) but did not score well on the technical question (**only 44%**).

- The mean score for 3D simulation was 3.1 on Q2. This was slightly lower than the scores for diagrams, worked examples and video clips, but **81.7%** of the students chose the correct answer for the technical question.

Conclusions

- The statistical data from the survey indicate that the conventional methods (e.g., diagrams, models and worked examples) are slightly more effective than the visualization methods (e.g., video clips and simulations) and wrong examples.

- The <u>model</u> was regarded as the best teaching tool.

- <u>No single teaching tool</u> was found to be far better than the others in this study.

Acknowledgment