Refresh & Debrief :   Chapter 4

From behaviorism to mastery learning

Pierre Dillenbourg

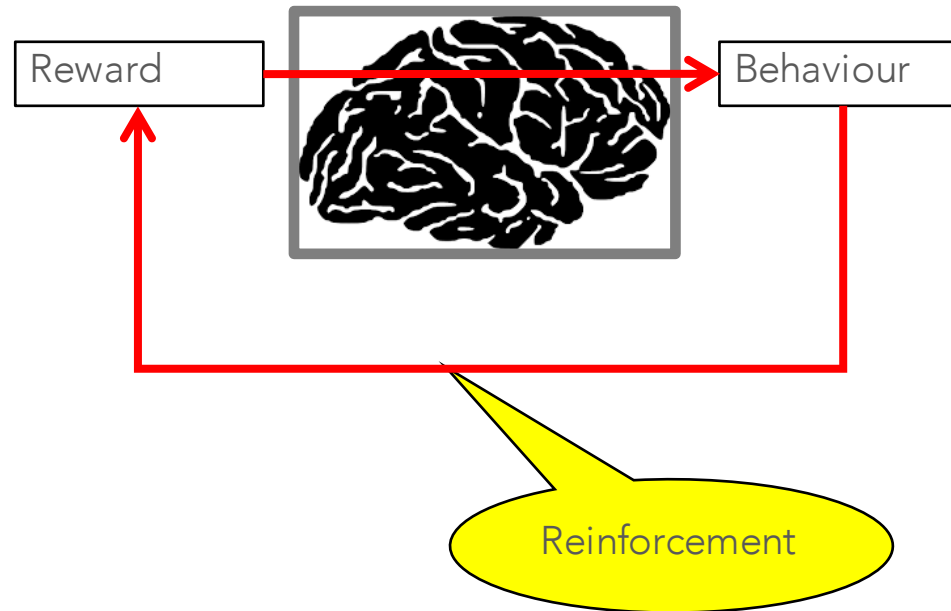How do people learn ? By conditionning
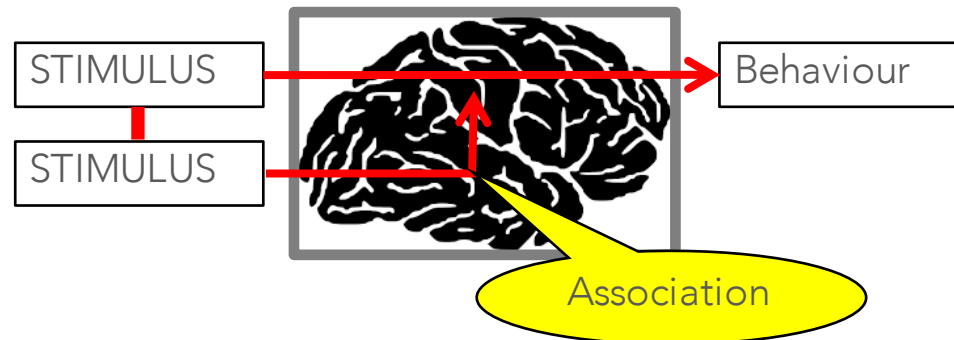
$$p\,(B \mid S)$$

analytics

Reminder of Chapter 2: **Behaviorism**
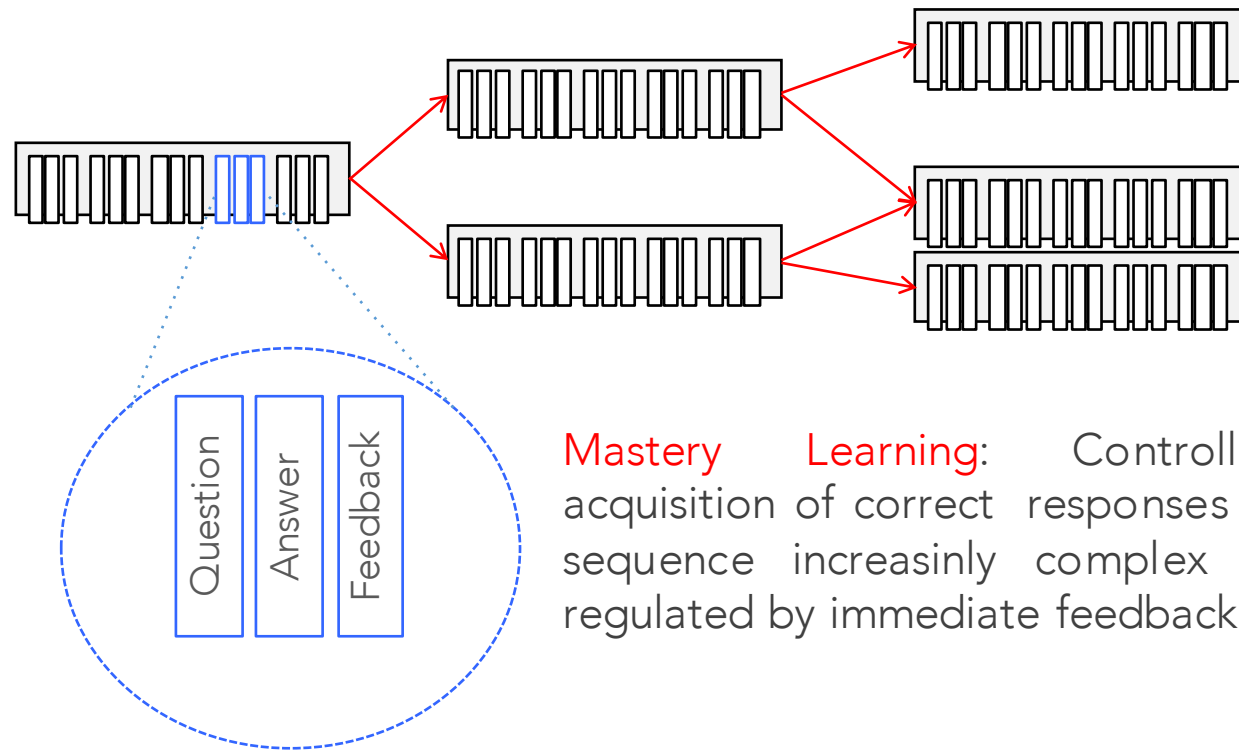
How do people learn ? By reinforcement

How do people learn ? ➜ Which technology for learning ?
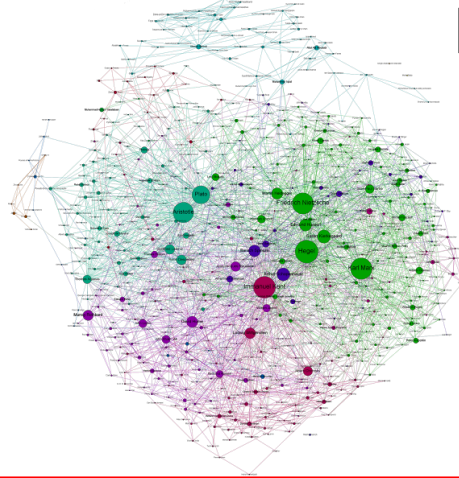
Reminder of Chapter 2: **Behaviorism**

How do people learn ? ➜ Which technology for learning ?
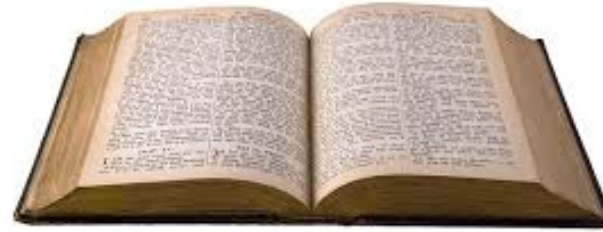Drill & Pratice, Courseware, e-Learning

Question | Answer | Feedback

Mastery Learning: Controlling the acquisition of correct responses through a sequence increasinly complex situations, regulated by immediate feedback.
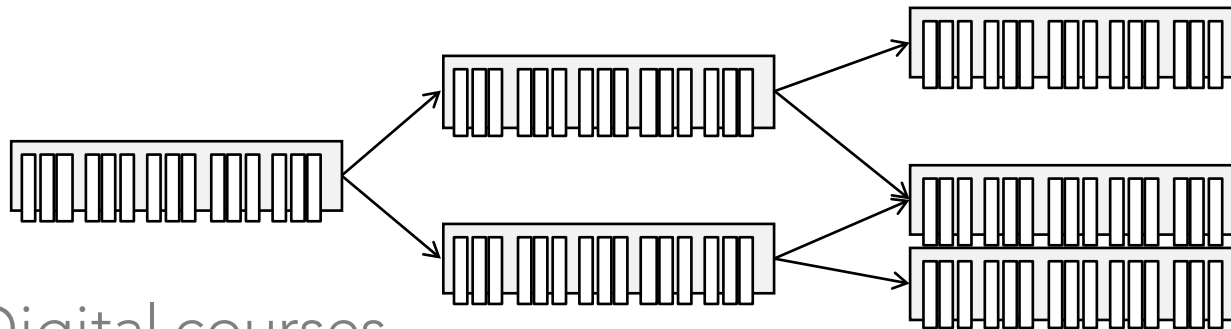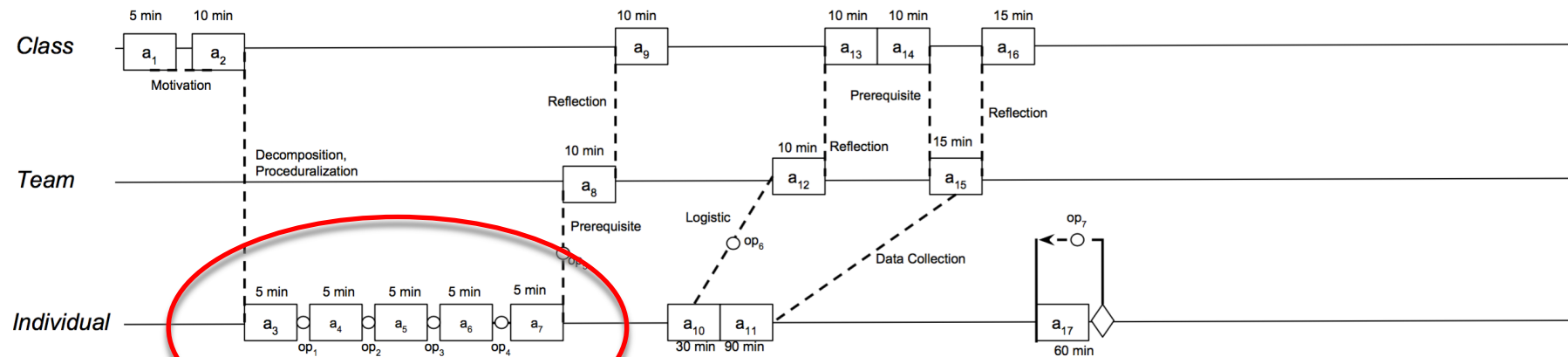
Knowledge space

Instructional Design

Digital courses

Criteria For Grading Assignment 2

1. Did you decompose the goal into steps ?

a₁: the students are given a motivating introduction, and class level discussion with some questions about standard deviation (SD).
a₂: the teacher shows the full formula of SD and goes through each step to demonstrate how to calculate SD.
a₃: To make the students learn how to solve SD step by step. exercises. The teacher puts five packs of exercises sheet according to each step in front of the students. The first step is computing summary.
a₄: the second step is computing the mean of serial numbers.
a₅: the third step is subtracting the mean from each number.
a₆: the Fourth step is computing the square.
a₇: the fifth step is finding a square root.
a₈: the students are allocated in pairs, and are given two exercise sheets which contain data with different SD to solve. the students need to make use of all the previous calculations learned to solve these two exercises.
a₉: After all pair finished the exercises, the teacher discusses the results and emphasizing the differences of high or low SD.
a₁₀: the students received the worksheet with exercises, and they need to complete it individually. Also, they need to report their Excel proficiency in the worksheet.
a₁₁: the students need to collect price data on some product.
a₁₂: In pairs, the students compare their homework worksheet answers.
a₁₃: the teacher shows the right solutions and discusses the meaning of results.
a₁₄: teacher demonstrates how to use Excel to the whole class.
a₁₅: In pairs, students enter their collected data and calculate the mean and SD in Excel.
a₁₆: each pair present their result in class with the teacher's feedback on found differences.
a₁₇: the students solve the online quiz with all the concepts learned during the week.
op₁: if the student correctly complete a₃ then do a₄; otherwise, the student do the question in the same pack with extra hints.
op₂: if the student correctly complete a₄ then do a₅; otherwise, the student do the question in the same pack with some hints.
op₃: if the student correctly complete a₅ then do a₆; otherwise, the student do the question in the same pack with some hints.
op₄: if the student correctly complete a₆ then do a₇; otherwise, the student do the question in the same pack with some hints.
op₅: if the student correctly complete a₇ then go to a₈; otherwise, the student do the question in the same pack with some hints.
op₆: the students are grouped based on their report of Excel proficiency, so that in each pair, there is one student who is good at Excel.
op₇: Mistakes are highlighted and students can redo the test.

**How our scenario achieves the three learning goals:**
Goal 1 is achieved by a₈ and a₉. A student can understand which kind of data will have higher or lower SD.
Goal 2 is achieved by a₈, a₁₁, a₁₀, a₁₅, and a₁₇. A student can compute the SD on several given samples.
Goal 3 is achieved by a₉, a₁₃, and a₁₆. A student will learn to identify which SD is the response by being led by a teacher to explore the data and gain the understanding of how to use in inference SD in realistic data.

The reasons of edges' label selection:
e₁,₂ (Motivation): a₁ makes a student want to know SD so that they are interested in understanding the formula (a₂).
e₂,₃ (Decomposition and Proceduralization): After overviewing each step of calculating SD (a₂), the teacher breaks the full formula into each step and practice by completing exercise sheets (a₃).
e₇,₈ (Prerequisite): A student needs to be familiar with each step to do the exercise in a₈.
e₈,₉ (Reflection): the teacher leads the students to analyze and comment on their answers.
e₁₀,₁₂ (Logistic): A student need to do the homework to discuss later with their partners.
e₁₁,₁₅ (Data Collection): A student needs the data that they collected before class to conduct a₁₅.
e₁₂,₁₃ (Reflection): the teacher presents the correct answer and leads the students understand why their answers are correct or wrong.
e₁₄,₁₅ (Prerequisite): the students need the basic understanding of Excel to be able to use it as a tool.
e₁₅,₁₆ (Reflection): the teacher leads students to inference the data they collected and makes the students understood how to apply SD on realistic data.

Criteria For Grading Assignment 2

1. Did you decompose the goal into steps ?
2. Are learners active and get feedback?
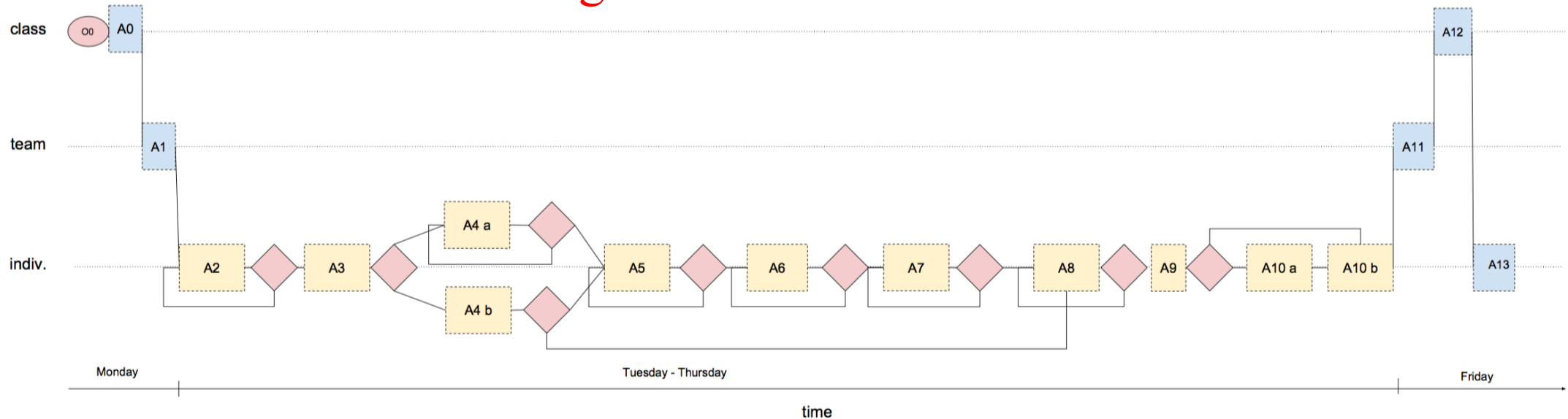
Activities and edges labelling :

A0: Show the two samples on a graph, explain the concept of sample. Show that one sample is more spread than the other => higher stdev and explain why. Show other examples of samples on graphs which have large or small stdev. M equal mean may correspond to widely differing distributions (and SD is a measure of this). **[edge A0-A1 = ZPD :** students take advantage of sharing information with some potentially more knowledgeable peer; **Deduction :** the concept w

A1 : Oral test in class : display graphs of samples, people discuss by groups of two and vote for the one who has bigger stdev, then the right answer is given. Use different representations : graphical (histograms), numerical. **[edge A1-A2** standard deviation**]**

A2 : Prerequisite tests on addition, subtraction, division, squares and square root. Loop over refresher exercises until success on all prerequisites (downhill strategy). **[edge A2-A3 = prerequisite :** students need to know about basic opera

A3 : Pre-test 1 : test on mean computation; if success => go to A4 b, if failure => go to A4 a. **[edge A3-A4 = prerequisite :** students need to know about mean before stepping to deviation.**]**

A4 a : Read tutorial on mean : http://www.freemathhelp.com/arithmetic-mean.html, then test on mean computation => loop until success **[edge A4-A5 = prerequisite :** students need to know about mean before stepping to deviation.**]**

A4 b : Pre-test 2 : test on standard deviation. If failed : go to A5, if successed : go to A8 **[edge A4-A8 = prerequisite :** students need to know about standard deviation before stepping to the post test.**]**

A5 : Read formula to compute a deviation from mean : deviation of a value = value - mean. Testing of deviation computation => loop until success **[edge A5-A6 = prerequisite :** students need to know about deviation before stepping to v

A6 : Read tutorial on variance : https://en.wikipedia.org/wiki/Standard_deviation#Basic_examples (variance part). Testing of variance computation => loop until success mean. Testing of deviation computation => loop until success **[edge** standard deviation**]**

A7 : Read tutorial on standard deviation : https://en.wikipedia.org/wiki/Standard_deviation#Basic_examples (stdev part). Testing of stdev concepts=> loop until success **[edge A7-A8 = Elicitation :** students are tested on the procedures th

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2. Are learners active and get feedback?
3. Do you keep control ?
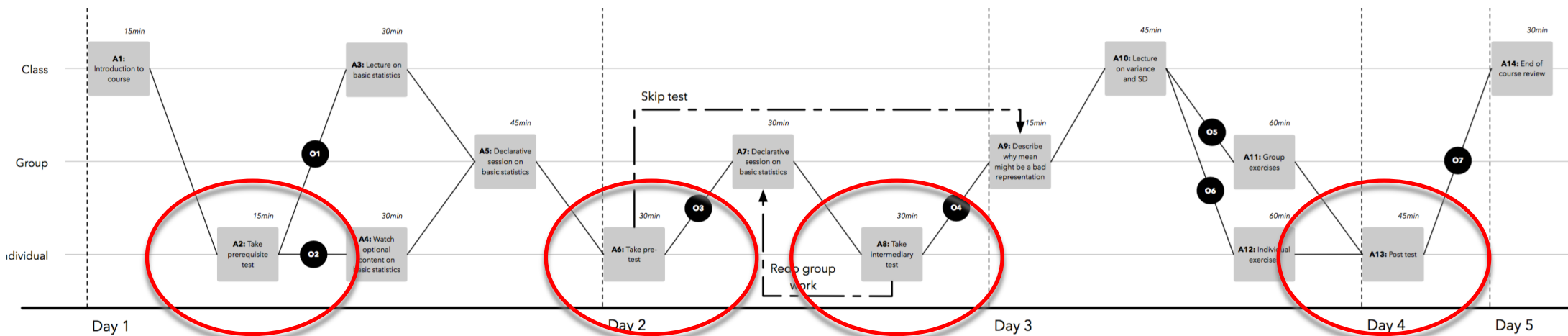
Description

This is a course given to refugees in the age of 14-20 with some prior knowledge of math (6-9 years). The course aims to teach the students about Standard Deviation (SD) over a 5 day period. Throughout the course the students will be given a series of tests to evaluate the level of their skill and to determine wether they have learned enough to proceed in the class. If a student does not have the needed skills they will be retaught and will thereafter have to take a test to confirm that they have acquired the needed knowledge. This step can be repeated if needed. To improve the students understanding of the taught material they will frequently be grouped up. In the groups they will need to explain concepts to each other. This is to improve their declarative knowledge. An effort is also made to accommodate different learning needs of students by giving them either group work or individual work.

Activities

A1: The teacher gives a short introduction to the course - what will be covered, what are the learning objectives and how is it structured.
A2: Students take a pre-requisite test to determine the level of knowledge of basic statistics. This is done in order to ensure that all students will have the required knowledge for taking the course and learning about SD.
A3: The students that (based on the test) didn't meet the pre-requisites are given a lecture to catch up. The teacher gives those students a crash-course in basic statistics. The lecture includes an example of a population and sample - the sample being the class. The students are introduced to frequency, mean, median, min & max.
A4: The students that met the pre-requisites are given an optional exercise. This is a video lecture on statistics from Khan's Academy
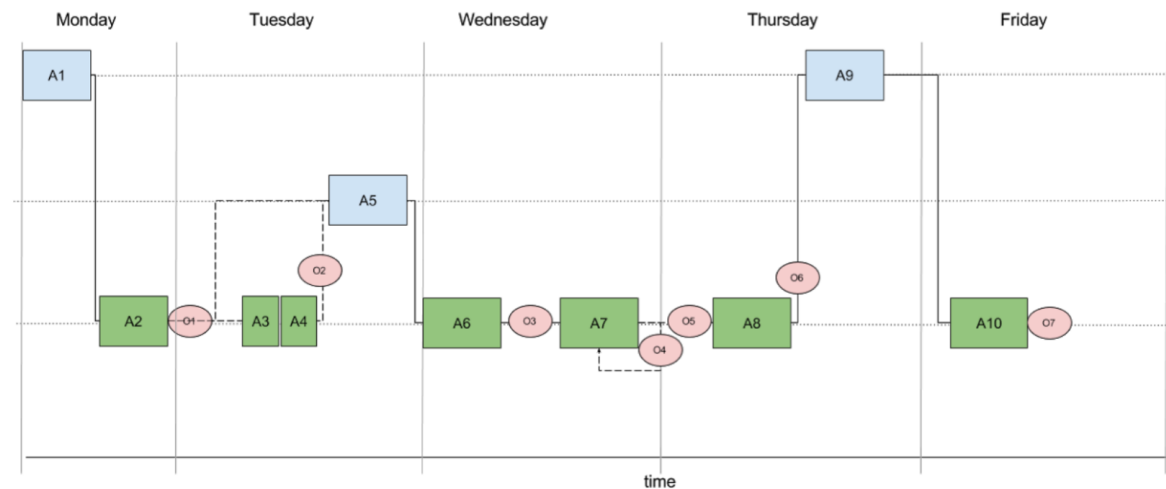
Operations

O1: Decomposition: Those students who fail the pre-test moves on to a basic lecture in statistics
O2: Decomposition: The students that already have the basic skills are given an optional exercise
O3: Students that fail the test move to A7
O4: Prerequisite: Students that pass the intermediate test qualify for the next module
O5: Students that prefer working in a group proceed to exercise A11
O6: Students that prefer working individually proceed to exercise A12
O7: The teacher goes through the tests and makes some statistics based on the results to be shown in the final session.

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4. Is the graph well formed ?
5. Did you specify the labels ?

+ Creativity Bonus

Mastery Learning

Trial & Error