Learn to Learn
Aprende a Aprender

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Banners of Education

- Concept of School: cultivate
  - independent,
  - creative and
  - critical thinking!
- Bologna ideas
  - Transmit to the student (and evaluate)
    - knowledge,
    - skills (know how to do) and
    - competences
  - Course Curriculum based on
    - competences
    - learning outcomes

Competences in Education

- Competence-based approach to education
  - You may define the competences, but …
  - How do you test them?
  - Where does this leave the **knowledge**?
  - Is knowledge really needed at the workplace?

Do we need Knowledge?
Learning Outcomes

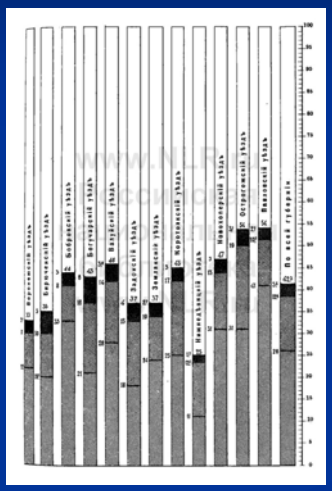
- ***Portuguese National Qualification Framework*** defines a **Master Degree**:
  - possess such knowledge and capacity of understanding that:
    - based on the knowledge obtained in the first cycle, they are able to develop and expand that knowledge;
    - are able to develop and apply that knowledge to original situations, often in the context of research;
  - know how to apply their knowledge and understanding and problem-solving capacities to new and unfamiliar situations in multidisciplinary situations, although related to their area of studies;
  - possess the ability to integrate knowledge, deal with complex matters, develop solutions and put forward opinions on situations of limited or incomplete information, including reflecting on the implications and ethical and social responsibilities that result from those solutions and opinions and that influence them;
  - are capable of communicating their conclusions and the knowledge and reasoning that underlie them clearly and unambiguously, to both experts and non-experts;
  - possess learning competences that will enable them to benefit from self-oriented or autonomous lifelong learning.

Summary

- Lack of properly assimilated knowledge in the long-term memory of the students
  - Destroys their capacity of abstract thinking
- Fundamental reason: refusal of the school to develop and use the memorization capacities
  - Mechanisms of memorization
- Ideas for improvement of learning results by individual student work

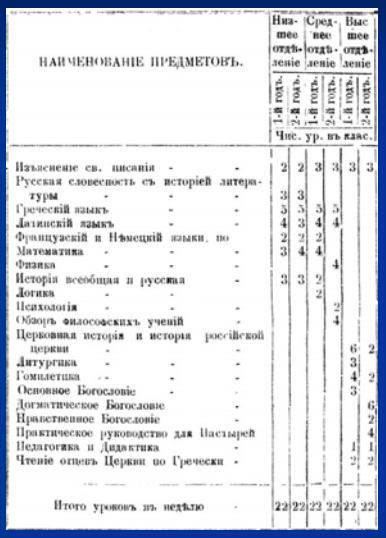
Primary education

Percentage of children at school, Voronezh, 1907



- Portugal, illiteracy:
  - 1900 - 78%
  - 1910 - 75%
- Russia, illiteracy
  - 1897 – 78.9%
- Russia, Voronezh district:
  - Census, illiteracy:
    - 1897 - 83.7%
  - 1907 - 42.3% of school-age children at school
  - Most in a "1-class" school (3 years; 3 study groups in 1 classroom with 1 teacher).

Secondary school



НАИМЕНОВАНІЕ ПРЕДМЕТОВЪ.	Низшее отдѣленіе		Среднее отдѣленіе		Высшее отдѣленіе	
	1-й годъ.	2-й годъ.	1-й годъ.	2-й годъ.	1-й годъ.	2-й годъ.
	Чис. ур. въ класс.					
Изъясненіе св. писанія	2	2	3	3	3	3
Русская словесность съ исторіей литературы	3	3				
Греческій языкъ	5	5	5	5		
Латинскій языкъ	4	3	4	4		
Французскій и Нѣмецкій языки, по	2	2	2			
Математика	3	4	4			
Физика				4		
Исторія всеобщая и русская	3	3	2			
Логика			2			
Психологія				2		
Обзоръ философскихъ ученій				4		
Церковная исторія и исторія россійской церкви					6	2
Литургика					3	
Гомилетика					4	2
Основное Богословіе					3	
Догматическое Богословіе						6
Нравственное Богословіе						2
Практическое руководство для Пастырей					1	4
Педагогика и Дидактика					1	1
Чтеніе отцевъ Церкви по Гречески					2	2
Итого уроковъ въ недѣлю	22	22	22	22	22	22

- Tomsk Theological Seminary, 1871
  - 6 years of studies
    - 4 years – general studies
    - 2 years – priest work studies
  - 22 lessons per week, including
    - Russian literature with history
    - Greek
    - Latin
    - French and German
    - Physics
    - Mathematics
    - History
    - Philosophy
    - Didactics
    - Russian
      - theological school (4 years, from 10 years of age)
    - Church Slavonic
      - theological school

Any progress in 100 years?

- "Education is what remains when we have forgotten all that we have been taught".
  - George Savile, 1st Marquess of Halifax (1633 – 1695)
- In the first place, God made idiots. That was for practice. Then he made school boards.
  - Mark Twain
- "With computers, kids can connect and search libraries and the Encyclopedia Britannica, but if you don't teach them to read in the first place, they're not going to [log on], are they?"
  - Ray Bradbury (1920-2012), 1995
- Portugal: 40% of the grade of the National Exam of Portuguese for "reading, understanding and interpreting a text"
  - Primary school competence

Functionally literate

- USA, 2003:
  - 65 to 85% - depending in definition
- Russia/Portugal, 1900:
  - 80% could not read, but:
    - did they have a necessity?

Inflation of values?

Scale 1 to 5	Scale 0 to 20	1884	2013
3	10-13	Good	Satisfactory
4	14-17	Very Good	Good
5	18-20	Excellent	Excellent

Diagnostic Test

- Please raise you hand as soon as you know the answer!
  - No calculators
  - Limited time

$$\frac{49+42+35+28+21}{7+6+5+4+3} = 7$$

You failed a test for a primary school competence.

How … ?

- Competences tested:
  - Multiplication table (primary school)
  - Algebra (secondary school)
    - Using primary school competences (arithmetic rules)

$$\frac{49+42+35+28+21}{7+6+5+4+3} = \frac{7\times7+7\times6+7\times5+7\times4+7\times3}{7+6+5+4+3} =$$
$$= \frac{7\times(7+6+5+4+3)}{7+6+5+4+3} = 7$$

Multiplication Table?

- *Stress Relief*
- *Satisfaction of Personal Achievement*
- Encouragement for future studies
- Basis for Mental calculations
- **Training of associative/referenced memorization**

- *Personal experience*
  - Summer Assignment after year 1 of primary school (8 years of age)
- *Multiplication table*: a pair of numbers gets **associated** with a third number
- *Poem*: line 1 gets **associated** with line 2, etc.
- *Abnormal* (limited usefulness)
  - Photographic memory: associated with location on the page?

Memorized, Anything?

- Diagnostic test
  - School curriculum of mathematics
  - Test; statistics; interview
- Test
  - 30 questions
  - Choice of 3 answers (1 correct)
  - No calculators/tables
  - 90 minutes
- Structure
  - Probability and statistics – 13% (4)
  - Algebra – 33% (10)
  - Analysis – 37% (11)
  - Geometry – 17% (5)

- PMAT project team (SPM)
  - Ana Moura (IST); Miguel Abreu (IST); Ana Rute (FCUL); Filipe Oliveira (FCUNL); Rogério Martins (FCTUNL); Helena Monteiro (IPT); Marília Pires (FCTUALG); Maria João Afonso (FPUL); Isabel Hormigo (Basic School); Isabel Nascimento (Basic School)
- Sample
  - 1st year students
  - 1398 on the total
    - 1230 – IST
    - 168 – UCP
  - Average entrance grade
    - **15.7 of 20**

…, Anything?

- Conclusions
  1. Knowledge carried over from School is **non-existent**
  2. Some improvement in derivatives (studied in the 1st semester)
  3. By September forgot everything studied in June-July
- Entrance grades matter
  - > 15.0: pass both disciplines of the 1st semester
  - < 13.0: fail one or both disciplines of the 1st semester
- Dates
  1. Before 1st semester
  2. After 1st semester
- Results (Grade 0 to 20)
  1. Mean 10/30 (0);
     Mode 13/30 (3);
     Max 22/30 (12);
  2. Mean 12/30 (2);
     Mode 14/30 (4);
     Max 26/30 (16);
- Not one person recognized it was the same test!
- Independent on gender, age and origin.

No, nothing!

Questions

- **Why** can't the students keep anything in their memory?
- **How** do they still manage to pass the disciplines?
- **What** should they do to improve their learning outcomes?

Introduction to Theory of Learning

Learning to Learn

Why and How do we Learn

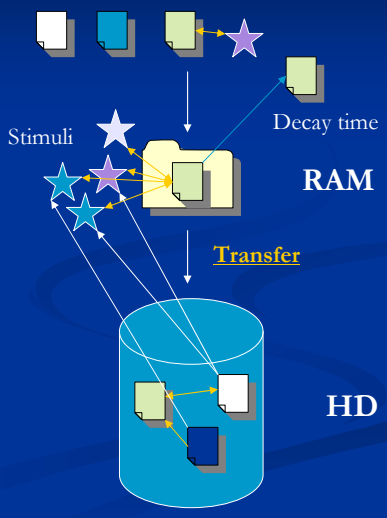
- Learning motivations
  - Discomfort and stress
    - Imperative (you must do it, or else you suffer)
    - Natural facilitators
  - Curiosity / Interest in knowledge
    - Optional
    - Present already in animals
- Memorization mechanisms
  - Short-term memory (up to about 2 weeks) = RAM
  - Long-term associative memory (permanent) = HD
- Repetition and variation of stimuli and memorization
  - Useful time frame
  - Repetition and variation

Stress and Learning

- Each and every day 6000 new neurons are born in our brain
  - If we are **stressed (uncomfortable)** and thus ***required*** to acquire new knowledge, competences and habits, these neurons are used and the brain is learning/developing
  - If we are comfortable and content, the brain is not stimulated / does not need to learn and the new neurons die
- Nature is economic: it only uses what is required
  - Every live being is lazy, by nature
  - Comfortable and content, it does not need to learn
- Students need to get uncomfortable and discontent with what they know, and aspire to know more
  - Manageable stress gets us learning
  - Specific motivations can be different

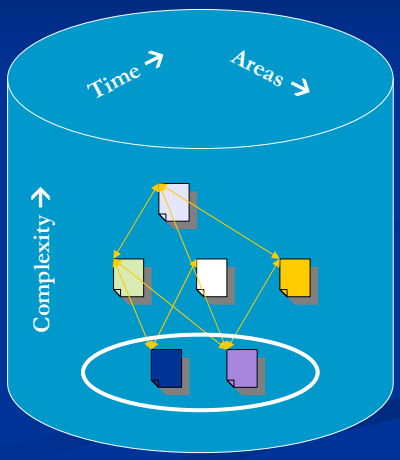
Memorization Mechanism

- Multiple and different stimuli are required to finally get a unit of knowledge onto the HD
  - Only the ***repeated/variable*** stimulation causes transfer into permanent storage
- **Associations** are created between new and already stored knowledge
  - Associations are only enabled by understanding (different levels of ***understanding*** are possible)



Definitions and Abstract thinking

- Abstract thinking requires permanent memorization
  - Permanent memory
    - Definitions get memorized
    - The more complex notions get associated to the definitions, etc
- Knowledge tree needs roots
  - Abstract knowledge needs associations to (already present) abstract knowledge
    - Learning by heart



Repeated and variable stimulation

- Variability facilitates creation of associations
  - Different units were created by ***different sources*** of stimuli
    - Visual, auditive, tactile etc.
  - Exploit ***all possible sources*** to maximize associations
    - Facilitated recalling
    - Increased usefulness
- Repetition on a short time frame enables **transfer**
  - Numerous stimuli in a short time frame / reasonable stress
    - The preferred option
  - Much more stimuli may be needed in a long time frame / low stress
    - We can't wait 20 years
  - One stimulus could be sufficient / huge stress
    - We can't afford life-threatening situations

Levels of Understanding

Ex.: Natural Catastrophes

- Empirical
  - Last time ***this*** happened, we tried to do ***that***, with ***such and such*** results
- Religious
  - It is the Will of our Lord that ***this*** happens
  - It is also the Will of our Lord that we should respond ***that way*** in such occasions
- **Scientific**
  - We have a theory that allows to understand these phenomena
  - This theory predicts that ***if this happens***, we should respond ***that way*** to avoid ***such and such*** consequences

Levels of Understanding & Learning

- **Scientific** understanding is a must!
  - Need to ***know the theory*** that allows to understand these phenomena
    - Memorize
    - Interpret
    - Use for predictions
    - Relate to different areas of knowledge
    - Understand limitations
    - Relate to new facts, recognizing relevance
- **Simple memorization** (*empirical understanding*) also needed!
  - ***Useful*** associations created gradually
    - Immediate associations allow reproduction: word-to-word (poem)
  - Definitions must be memorized literally
    - Need a common language
  - Need to know theories by heart
    - Otherwise we can't relate them to facts

School & University: from Empiric to Scientific Understanding

Ex.: Mathematics

- School
  - Memorized rules of mathematics
    - Empiric understanding (do it this way – the rules say so)
    - Basis for arithmetic calculations
- University
  - Theory
    - Theoretic understanding of the rules
    - Sophisticated mathematical tools
- Both levels of understanding are required!

Learning Effort: How much is Enough?

- Defined for a discipline
  - Chemistry (degree: Pharmacy; ECTS)
    - 110 hrs out of classroom; 58 hrs in classroom
    - 15 weeks in a semester
    - Exam: 3 days × 8 hrs = 24 hrs
    - Weekly: 6 hrs (daily: 1 hr 12 min)
  - Working day: 8 hrs * 7 days/week (6 disciplines)
- Students do work for a discipline
  - < 2 hrs/week (mathematics; U. Algarve)
    - Fail the discipline (by exam; may pass by tests …)

Questions

- **Why** can't the students keep anything in their memory?
- **How** do they still manage to pass the disciplines?
- **What** should they do to improve their learning outcomes?

School does not teach the Average Student

- Average grades in Portuguese: 7/20.
  - "Improved" by ME 5 years ago (7 → 12)
- Average grades in Mathematics: 7.
  - "Improved" by ME 5 years ago (7 → 12)
  - Difference: decay of the short-term memory!
- School desertion rate: 40%
  - Not finishing 9th year: 1.7% in 2011 – improvement from 12.6% in 1991, by administrative pressure
- The School manages to teach *something* to only 2 students of 10 who enter into the 1st year of primary at 6 years of age.
  - With the help of private tutors.

Diagnosis of the School

- A ***wrong method*** of teaching to read (global/visual method)
  - Limited and inextensible vocabulary
  - Inability to reason
  - With consequences for the Portuguese and all of the other disciplines
  - Extreme case: Ellochka The Cannibal (*used 30 words and phrases*; Ref.: I. Ilf and E. Petrov, "The Twelve Chairs", http://lib.ru/ILFPETROV/ilf_petrov_12_chairs_engl.txt)
- An ***incorrect paradigm*** of the intellectual development of the students ("independent, critical and creative thinking")
  - Attempting to use ICCT when is does not exist (waste of time; morally doubtful)
  - **Refusal to develop and use the long-term associative memorization**
  - With consequences for all the disciplines, Mathematics and Philosophy in the first place

Knowledge: Life or Death

- Indonesian Tsunami, 2004
  - A British girl, Tilly Smith, who studied properly, and
  - Five indigenous tribes on Andaman and Nikobar islands that memorised the tales of their oral tradition 20000 years old, ***vs***
  - Modern humans armed with Critical, Independent and Creative Thinking

Historic Digression

- The role of the Oral Tradition and Associative Memorization
- In the Development of Humanity
  - Writing is 5 to 6 thousand years old
  - Oral tradition is tens of thousands years old
- Learning
  - Animals: personal presence at the events and repeating actions
  - Humans: + oral tradition and writing

Questions …

Asked

- **Why** can't the students keep anything in their memory?
- **How** do they still manage to pass the disciplines?
- **What** should they do to improve their learning outcomes?

Answered

- They only use short-term memory.
- Alternative:
  - The only associations that can be created are those to circumstances of the classroom work (pretty useless),
  - Instead of those to other assimilated (and duly associated) knowledge, for lack of any such knowledge.

Quantitative results: Marília Pires et al.

- Students are using short-term memory – RAM
  - ***Only***!
- Not using long term memory – HD
  - Don't know how
    - Using their school study habits
    - Preparing "for the tests" and "for the exams"
  - Don't need to
    - Evaluated by tests, several tests in a semester
    - With only a small amount of material for each test

We have a problem

- **Student Evaluation by Tests**
  - Subject matter of a discipline is divided into several parts;
  - Student is able to hold each of those in the short-term memory;
  - Passes the test, and the discipline;
  - And forgets it all right away;
  - Having never ***understood*** any of it.
- Everyone loves tests
  - Students – they can pass this way, but would fail exams;
  - Professors – students pass.
- Add some reports and group assignments – and – miracle!
  - Good Grades, and
  - Clean Conscience,
  - But – Empty Heads, and
  - Life Wasted …

University: to do Now

- Evaluate students by exams and not by tests
  - Tests only evaluate what you have in your RAM
    - RAM is volatile and
    - Low capacity
  - Exams evaluate what you have on your HD
    - HD is non-volatile and
    - High capacity

Questions …

Asked

- **Why** can't the students keep anything in their memory?
- **How** do they still manage to pass the disciplines?
- **What** should they do to improve their learning outcomes?

Answered

- They only use short-term memory.
- They are approved in tests; need short-term memory only.

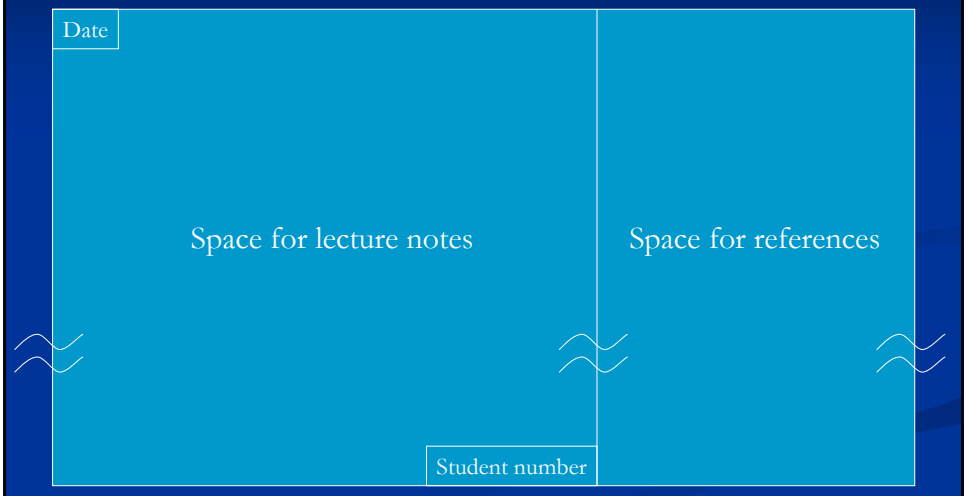
What to do?

- Use long-term associative memory (HD) in learning
  - Write lecture notes
  - Compare lecture notes to the textbook
    - Make references
  - Identify things you don't understand
  - Ask questions in the class
    - Make references
  - Do home assignments
    - Make references
    - Individually defend home assignments
- Learn definitions, rules etc. by heart.
- Work systematically during the entire semester
  - Maximize the number of times you get in contact with new study matter within the same week
    - Write lecture notes by hand!
  - Write out and decorate definitions
  - Write out and decorate formulas and understand the quantities that enter in the formulas
  - Write out and decorate important numbers
- Work out of classroom at least the same number of hours that you spend in the class

More from colleagues

- Read the textbook at least 3 times (*M. C. Mateus & others*):
  - 1 – with the pencil/marker, to underline the important things;
  - 2 – to understand the more difficult things;
  - 3 – to get the entire picture.
- Reviewing before exams (*A. Newton*):
  - Concentrate on things that seem difficult,
  - Usually because you don't understand them,
  - Things you are comfortable with require less of your attention.
- Repeated reviewing at growing intervals *(???)*
  - 1 week
  - 1 month
  - 6 months
  - …

Page of your workbook



Algorithm - 1

- 1-2 days before the lecture
  - Read the subject matter to be lectured next in the textbook
  - Write our the definitions into your workbook
    - Try to decorate them
  - Find the meanings of the words you don't understand
    - Write them out
  - White out the formulas
    - Try to memorize them
    - Work out the units of every quantity entering the formula
    - Do some sample calculations
    - Memorize the important numbers (universal constants; results of a typical calculation)
  - Formulate things you don't understand
    - Prepare your questions
- On the lecture
  - Write lecture notes in your workbook
  - Focus on things you did not understand while reading the textbook
    - Did you get to understand them at the lecture?
    - No – ask your questions in the end of the lecture
      - Make notes
    - Yes – you are fine
  - Listen to questions your colleagues ask and to the answers
    - Maybe you did not understand this as well
    - Make notes if necessary

Algorithm - 2

- 1-2 days after the lecture
  - Re-read the subject matter of the last lecture in the textbook
  - Compare it with your lecture notes
    - Any contradictions?
    - Anything you don't understand?
    - Formulate you questions to the professor
  - Make references in your workbook, pointing to pages/lines where the textbook explains what was outlined in the lecture, in particular:
    - Definitions
    - Formulas
    - Constants
- Solve some of the exercises proposed in the textbook
  - Start from those that have similar exercises solved in the chapter
  - Solve some more of those proposed at the end of the chapter
    - Start from those that have answers
    - Are you able to reproduce the answers?
    - No – formulate your questions
    - Yes – you are fine
- Make references to the solved exercises in your lecture notes
  - Showing which part of the subject matter they illustrate

Algorithm - 3

- In the beginning of the next lecture
  - Ask your questions about the previous lecture
    - Make notes in the appropriate location
  - Listen to what your colleagues are asking about
    - Make notes
- If you plan to do something else at the lecture, don't bother to come
  - Don't let us interfere with your life
- If you are late, don't ask for permission to enter
  - Why do you have to interrupt us?
- Preparing for the exam
  - Re-read your lecture notes
  - Look through the exercises you have solved
    - Recall why did you solve it the way you did
    - Recall the formulas involved
    - Recall the units of each of the quantities
  - Re-read the textbook, at least those parts you had difficulties in understanding initially
  - Re-read you lecture notes

Make your life choice …

- Study to acquire knowledge that will be reusable for years to come
  - Work systematically, work more
  - Prepare for the exams
  - Get to know something
- Or: Continue with your old study habits
  - Work during 3 days "studying for the test"
  - Forget everything after the test
  - Keep your head empty

Questions …

Asked

- **Why** can't the students keep anything in their memory?
- **How** do they still manage to pass the disciplines?
- **What** should they do to improve the learning outcomes?

Answered

- They only use short-term memory.
- They are approved in tests; need only short-term memory to achieve that.
- Use long-term associative memory.

Are we missing anything?

- "He who learns but does not think, is lost. He who thinks but does not learn is in great danger."
  - Confucius
- "Those who know nothing must believe everything."
  - Marie Von Ebner-Eschenbach
- I have never let my schooling interfere with my education.
  - Mark Twain
- "If you think you know it all, you are missing something."
  - Thomas Robert Dewar
- "Those who know nothing of foreign languages know nothing of their own."
  - Johann Wolfgang von Goethe
- To succeed in life, you need two things: ignorance and confidence.
  - Mark Twain

Evolutionary aspect

- Long-term memory
  - Mammals
    - Elephants
  - …
- Communication
  - Sign language
  - Learning by example
- Abstract thinking
  - Chimpanzee taught human language?
    - = 5-year old human child

- Do not limit yourself to the prehistoric level of intellectual development!

Additional conclusions/questions

- Knowledge, *apparently absent*, is not the requirement of the job market
  - Not the short-term necessity in most professions
    - Excluding e.g. science:
    - Our paper to be published on polit.ru
  - But: required for life-long learning
- Religious education of underage children
  - Is the abuse of their *individual* freedom of conscience
  - By their parents
  - And the only way the religious organizations can increase their membership
- Religion alters your mind
  - ⇔ sex
  - ⇔ alcohol
  - ⇔ drugs
  - …

Youtube: Pat Condell

To know more

- Статья на сайте poli.tu – искать по фамилии автора (Хмелинский)
- My blog – to read and *discuss*:

Educação em Portugal – Metas e Medidas

http://educacao-em-portugal.blogspot.com

http://goo.gl/7yvA7

Educational Reform Succeeded