



UNIVERSITÀ
DI TORINO



DBMSS

Dipartimento di Biotecnologie
Molecolari e Scienze per la Salute

Open Educational
Resources,
Learning Analytics
and Good Practices

Marina Marchisio

Università degli Studi di Torino

With the patronage of



OER - Open Educational Resources

2

Open Solutions

3

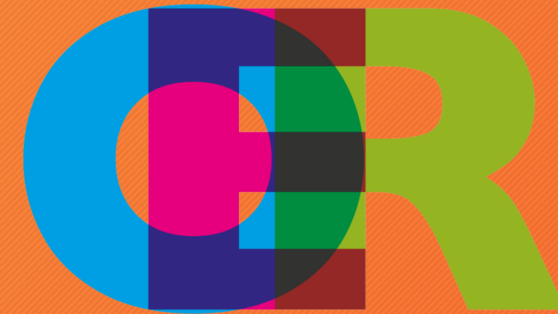
Open
Education

Open
Source

Open
Access

Open
Data

Open
Science



OPEN EDUCATIONAL
RESOURCES

Picture from [Wikimedia Deutschland e. V.](#),
Author [Markus Büsges](#)

OER - Benefits



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- **Access:** anywhere and anytime
- **Cheap:** time saving (teachers), money saving (students)
- **Interaction:** inside a community
- **Quality:** anyone can contribute
- **Quantity:** high amount of contents
- **Speed:** immediate dissemination
- **Teaching:** supporting different styles
- **Variety:** different ideas and perspectives

Pay attention to quality

5

- Anyone can post online materials
- The role of the teacher is then fundamental to avoid irrelevant or inaccurate information
- **Quality measurement:** peer evaluation, rating, ...

OER: Examples

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- Online courses
- Multimedia
- Animations
- Simulations
- Interactive materials
- Texts
- Books
- Papers
- Presentations
- Automatic tests
- Learning Objects



Which rights? The 5R!

7

Retain

Re-use

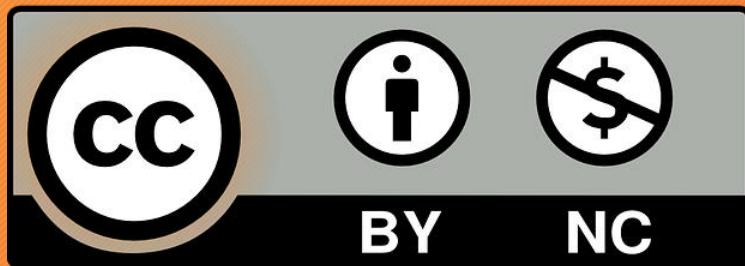
Revise

Remix

Re-distribute

Creative Commons

8



University of Turin - New technologies

9

Open online platform

Open Online Courses

Advanced Computing Environment

Automatic Assessment System

Web Conference tool



EasyReading

Methodologies: Formative Assessment

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- Immediate and interactive feedback which works at
 - Task level
 - Process level
 - Self-regulation level
- Adaptive learning
- Algorithm-based questions

Test finale 3 Remaining Time: Unlimited

Question 5
1 point

Una possibile espressione della funzione f il cui grafico è rappresentato in figura è:

$4e^x$

[Submit Assignment](#) [Quit & Save](#) [Back](#) [Question Menu](#) [Next](#)

OER - At the University of Turin

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SMART

Science and Mathematics Advanced Research for good Teaching

- OER enhance professional development of Secondary Schools teachers
- OER enhance success of Secondary Schools and university students
- OER enhance success of students and professional development of teachers at University



start@unito

Teacher training

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Digital Education Action Plan 2021-27
DigCompEdu 2016
Key Competences for Lifelong Learning
European Commission



DigCompEdu
The European Framework
for the Digital Competence
of Educators

These guidelines were taken into account in the “*Problem Posing & Solving*” project of the Italian Ministry of Education (STEM disciplines) coordinated by University of Turin

The screenshot shows the SMART website interface. At the top left is the SMART logo with the tagline "Science and Mathematics Advanced Research for good Teaching". To its right are the Erasmus+ logo and a "Log in with Google" button. Below the navigation bar is a search bar with "OpenSMART" and "SMART Project site" options. The main banner features the text "How teach the new math?" over a background of mathematical terms like "applications", "one definite", "limit", "cent", "second phys", "line", "theory", "functions", "Change interval", "time", "Limits", "points", "gives", "Books", and "findings". Below the banner is a section titled "Available Moocs" with navigation arrows. Three Mooc cards are visible: "Mathematical Modelling" with a chalkboard image, "Observing Measuring and Modelling in Science" with a science experiment image, and a partially visible "Observing Measuring and Modelling in Science" card.



Professional development of teachers

- European Erasmus +
Science and Mathematics Advanced Research for good Teaching



RADNOOTI



UNIVERSITÀ
DI TORINO



OBJECTIVES

- improve professional competences of **STEM teachers**
- support innovation in teacher training system
- provide teachers with an online environment where to find teaching materials that are validated and ready for use in the classroom



OpenSMART SMART Project site My courses ▾

Home > MOOCs > Mathematical Modelling > The birthday paradox

The probability is already beyond 0.9 with $n = 40!$

▼ **The Mathematics behind the problem**

▼ **Classical definition of probability**

OpenSMART SMART Project site My courses ▾

Home > MOOCs > Mathematical Modelling > The ramp

THE RAMP

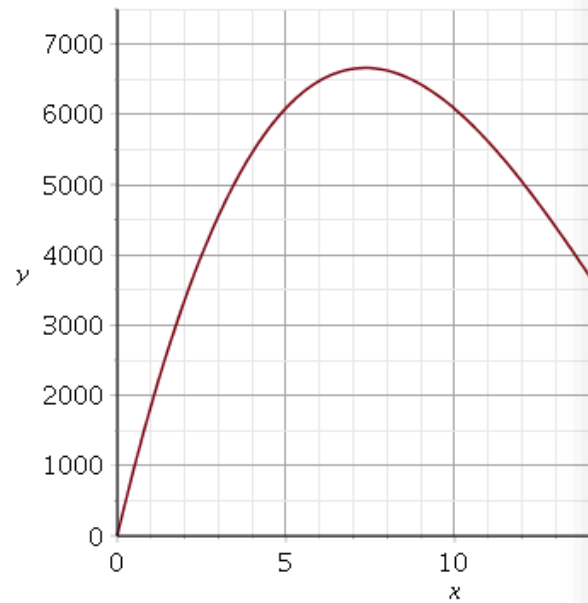
▼ **Problem**

To access a public building there are 6 steps which are 16 cm high and 30 cm deep; you need to build an access ramp for wheelchairs. The regulations hold that the slope (i.e. the ratio between the vertical and horizontal displacement) of the ramps must be lower than 8%.

1. What is the maximum angle that a ramp can form with the ground?
2. The space available in front of the staircase is 260 cm. Does a ramp that runs near the stairs occupying the entire space match with the requirement?
3. Along the wall of the building next to the stairs it is possible to build a dual ramp, as in figure; each of the two ramps can be developed, horizontally, for 650 cm. Is the ramp built in this way matching the law requirements? What is the inclination of the ramp?











Given the following graph, depicting a cubic that models a maximum, the x-axis includes the maximum?



In the following table there are two columns: in the first one there are angle amplitudes expressed in degrees while in second one they are expressed in radians.

Complete the table:

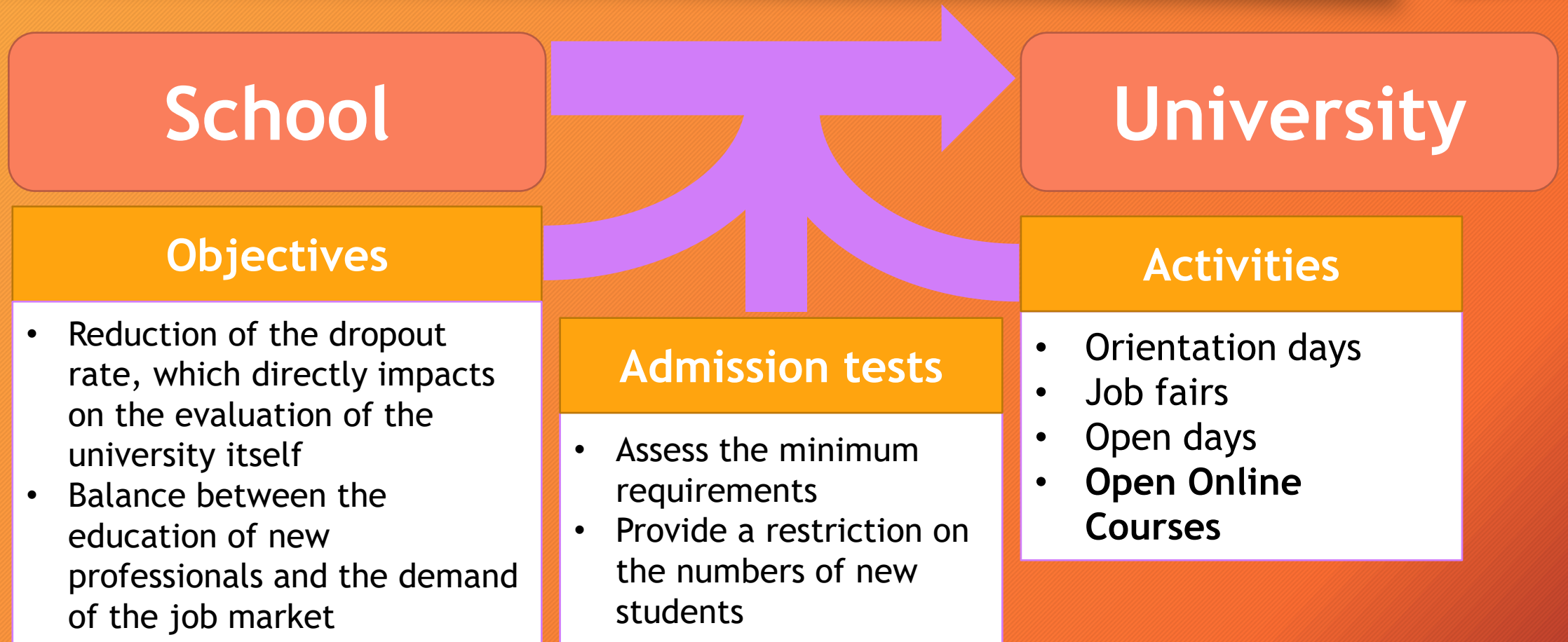
For the symbol π you can write *Pi*

Amplitude(°)	Amplitude(rad)
90	$\frac{1}{2} \pi$
60	<input type="text"/>  
145	<input type="text"/>  
<input type="text"/>  	$\frac{47}{36} \pi$
<input type="text"/>  	$\frac{1}{6} \pi$

Submit Assignment

Submit Assignment





Orient@mente

<https://orientamente.unito.it>

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The screenshot shows the website's header with the University of Turin logo and the 'orient@mente' logo. Below the header are social login buttons for Facebook, GitHub, Google, and LinkedIn. A navigation bar includes 'Front page', 'UniTO', 'HelpDesk', and 'English (en)'. The main content area features a 'Login' form with fields for 'Username' and 'Password', a 'Remember username' checkbox, and a 'Log in' button. Below the form are 'Social Network Login' buttons for Facebook and GitHub. A large compass graphic with the 'orient@mente' logo is centered on the page. At the bottom, a yellow banner asks 'Non hai ancora le idee chiare su quale corso di studio intraprendere?' and provides a link to 'Apri la categoria "Esplora i Corsi di Laurea"'. A small 'CAREER' compass icon is also visible.



Bridge between
secondary school
and univeristy

Compagnia
di San Paolo



To help students make a responsible choice about academic studies

- Interactive paths for university guidance
- Exploration of courses
- Recovery of gaps
- Preparation for admission tests
- OOCs for revision of basic knowledge
- E-Tutoring


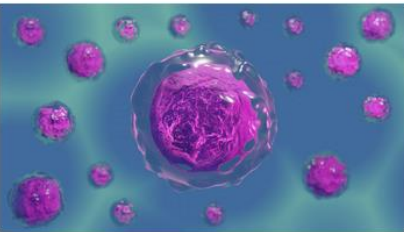


Dashboard UniTO HelpDesk I miei corsi Italiano (it)

Home > Corsi > Esplora i Corsi di Studio dell'Università degli Studi Torino > Esplora i Corsi di Laurea dell'Università degli Studi di Torino > Biotecnologie

Biotecnologie

Benvenuti nella pagina dedicata al Corso di Studio in Biotecnologie. Qui potrete trovare un aiuto per fare una scelta serena e consapevole.



Dashboard UniTO HelpDesk I miei corsi Italiano (it)

Home > Corsi > Esplora i Corsi di Studio dell'Università degli Studi Torino > Esplora i Corsi di Laurea dell'Università degli Studi di Torino > LT - Lingue e Culture per il Turismo

Lingue e Culture per il Turismo




Il turista, in tutte le sue varianti, nel più o meno breve periodo che gli è concesso per essere turista, è in qualche modo una persona diversa
(Aime e Papotti, *L'Altro e l'Altrove*, 2012, p. XI)



Corso di Riallineamento in Chimica

Ti consigliamo di seguire la breve guida prima di iniziare la navigazione del Corso in modalità e-learning: [clicca qui](#) per accedere alle lezioni.

Clicca sull'immagine  per aprire la mappa concettuale del corso

1. Atomi e molecole

2. Configurazione elettronica degli elementi

Gli atomi interagiscono tra loro attraverso lo spazio occupato dagli elettroni. Le proprietà chimiche dipendono da come gli elettroni sono distribuiti intorno al nucleo. In questo modulo è riportata la descrizione degli orbitali atomici e sono espone la regola che, definendo la disposizione degli elettroni attorno al nucleo, permettono di ottenere la configurazione elettronica degli elementi.

2. Configurazione elettronica degli elementi

2.1. Gli orbitali atomici

Le soluzioni dell'equazione di Schrödinger: i numeri quantici principali e le proprietà degli orbitali.

INSEGNAMENTO
Scuola
Università

INTERDISCIPLINARE
Finanza
Ingegneria
Biologia / Medicina
Meteorologia

ICT
Centri di ricerca di Industrie / Banche / Assicurazioni

MATFMTICA
RICERCA
Università
Centri di ricerca di Industrie / Banche / Assicurazioni

MESTIERI DEI MATEMATICI

LAVORO DIPENDENTE IMPIEGATO / TECNICO
Industrie
Banche / Assicurazioni
Pubblico
Società Servizi

CONSULENZE
In proprio
Società Consulenze

INFORMATION COMMUNICATION TECHNOLOGY
Programmatore
Siti Web
Sicurezza informatica
Crittografia
Computer Graphics

Logistica / trasporti

Analisi del rischio

Data Analysis

Organizzazione

ICT

Analisi del rischio

Data Analysis

Comunicazione Scientifica

Programmatore

Siti Web

Sicurezza informatica

Crittografia

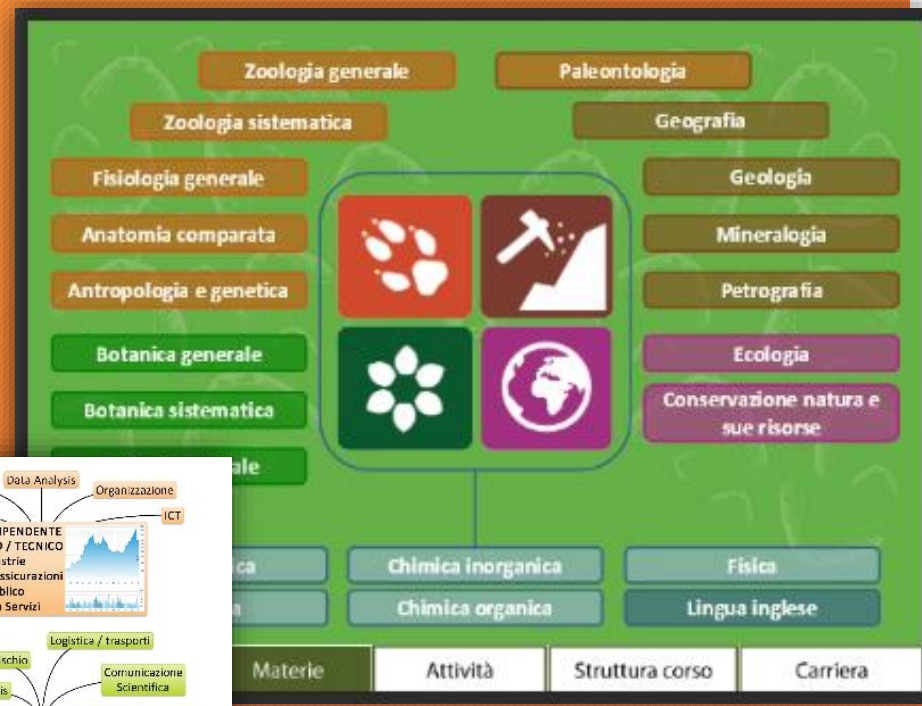
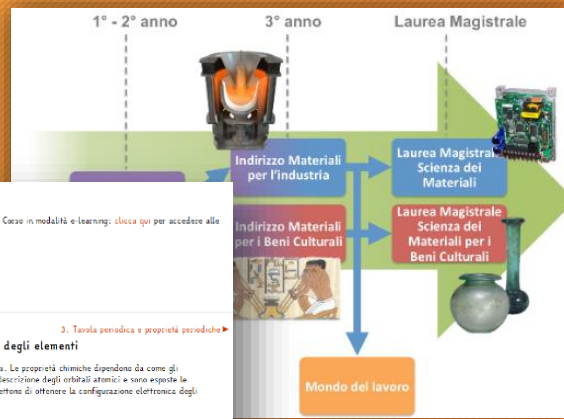
Computer Graphics

Il metodo di Aufbau

2.2. Il metodo Aufbau (slides)

Test modulo 2

1. Atomi e molecole



84196 users



- Automatic Evaluation
- Interactive Feedback



Total grade: 0.0/1.1 = 0%

Comment:

Question 24: Score 0/1

Your response: indica la corretta definizione degli stami: (0%)

Correct response: **costituiscono la parte fertile maschile del fiore delle Angiosperme**

Total grade: 0.0/1.1 = 0%

Comment:

Question 25: Score 0/1

Your response	Correct response
Nel sistema visivo umano, i <input type="checkbox"/> sono responsabili della visione a colori, mentre <input type="checkbox"/> sono responsabili della visione in bianco e nero. Questi ultimi sono più adatti alla visione durante la notte.	Nel sistema visivo umano, i coni sono responsabili della visione a colori, mentre i bastoncelli sono responsabili della visione in bianco e nero. Questi ultimi sono più adatti alla visione durante la notte.

Comment:

Question 26: Score 0/1

Your response: L'empiozima è una proteina situata all'interno dei globuli rossi ed è responsabile del trasporto dell'ossigeno.

Correct response: L'empiozima è una proteina situata all'interno dei globuli rossi ed è responsabile del trasporto dell'ossigeno.

Una soluzione liquida può essere formata da:

- un solvente solido e un soluto
- un solvente gassoso e un soluto
- un solvente solido e un soluto
- un solvente gassoso e un soluto
- un solvente liquido e un soluto

Il sistema di equazioni

$$\begin{cases} kx - y = 2 \\ 2x + y = 1 \end{cases}$$

con x e y reali e k parametro reale.

Il **red shift**, cioè il fenomeno per cui la frequenza di oggetti celesti lontani ci appare spostata verso valori minori rispetto a quelli effettivamente emessi dalla sorgente, a quale **effetto fisico** è collegato?

- Effetto fotoelettrico
- Effetto Seebeck
- Effetto Joule
- Effetto Doppler

(2) Chi l'ha detto? Collega ciascuna definizione a chi la enunciò.

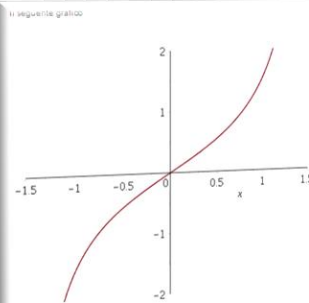
Office of Technology Assessment | WIG | Rosen

1. La diversità biologica è una sorgente di ricchezza materiale e culturale.
2. La diversità biologica è intesa come ogni tipologia di variabilità tra organismi.
3. La diversità biologica è la differenza che si trova in tutti i livelli di organizzazione della vita.
4. La diversità biologica è definita dalla varietà e variabilità degli organismi che si muovono.

(3) Lo scopo principale di questo testo è

- Esporre i diversi livelli di organizzazione della biodiversità.
- Spiegare il concetto di diversità biologica secondo Edward O. Wilson.
- Denunciare la poca attenzione riservata al tema della biodiversità.
- Nessuna delle risposte precedenti.

Il seguente grafico

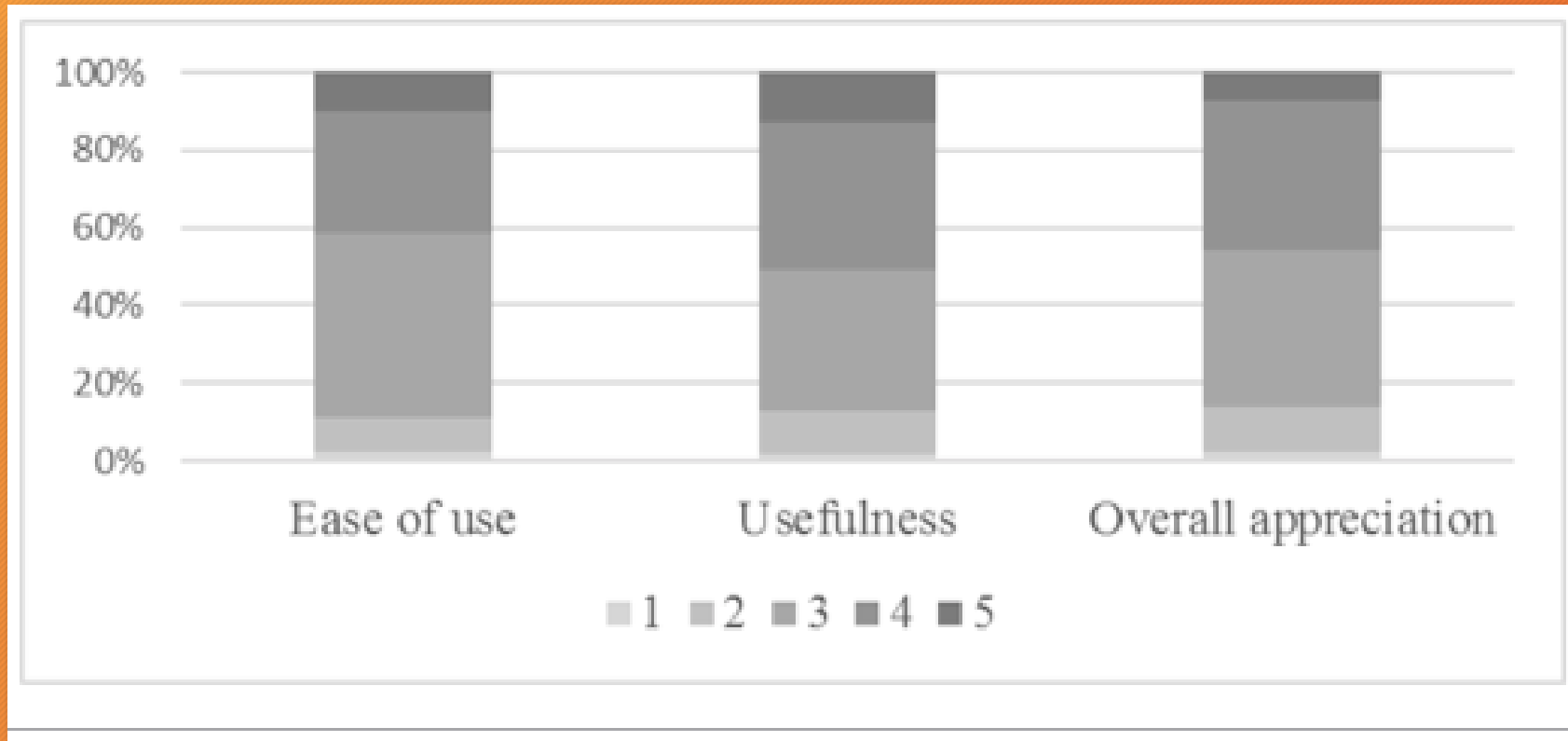


rappresenta la funzione:

- $y = x^3$
- $y = x^2$
- $y = x^4$
- $y = \tan(x)$

Orient@mente Evaluation

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Analytics of students improvements

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The size of the dataset is 29,256 observations

SS1 - 22.38%

SS2 - 77.62%

students who are
Orient@mente users

students who are not Orient@mente users



Analytics of students improvements

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Check the equality between the average **number of ECTS** achieved by the students at the end of the first academic year in the subsamples (SS1) and (SS2).

p-value < 0.0001

Check the equality between the **weighted average grade** of students between the subsamples (SS1) and (SS2).

p-value < 0.0001

There is statistical difference that shows the benefits of Orient@mente OER



Start@unito

<https://start.unito.it>

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start@unito

Log in with Facebook

Log in with Google

UniTO HelpDesk English (en)

start@unito

Get a head start in your university studies
Discover the Courses showroom

more ...



Enhancement of students' success
Transition to new ways of teaching



50 open online courses in different subjects
Number of users: 63445

OBJECTIVES

- Promote and facilitate the **transition** from secondary school to the university system
- Orientation
- Support for starting a university career
- Overview of the university education path





Antropologia culturale

Esplora



Come nasce e come funziona un farmaco?

Esplora



Cos'è la filosofia?

Esplora



Lingua russa prima annualità

More



Lingua spagnola prima annualità

More



Lingua tedesca prima annualità

More



Macroeconomics

More



Diritto alla salute (Tutela della salute)

Esplora



Economia e azienda

Esplora



Elementi di logica matematica

Esplora



Marketing

More



Matematica in e-learning

More



Mathematical modelling

More



Media e comunicazione

More



Area Umanistica



Area Economica



Area Giuridico-Politica



Area Linguistica



Area Scientifica

Military sociology and leadership
International law
History of European integration
Mathematical modelling
Interpreting macroeconomic scenarios
International law and taxation
Financial accounting and business administration (modulo di financial accounting)
Marketing
EU public law for economics
Private law
Business law
Macroeconomics
Cell physiology
Developmental neurobiology
International law and new technologies
EU law and fundamental rights
Anti-discrimination law
Legal English

Example of OOCs in English



Area Umanistica



Area Economica



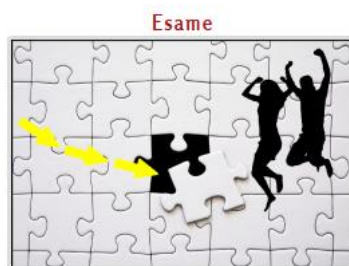
Area Giuridico-Politica



Area Linguistica



Area Scientifica



Accessibility

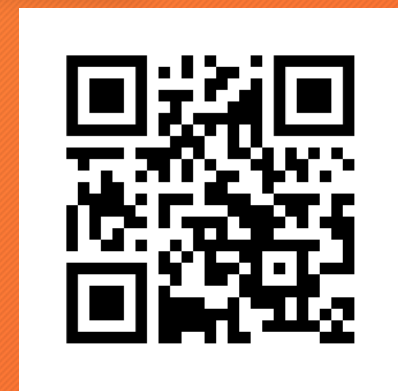
A- A A+

R A A A

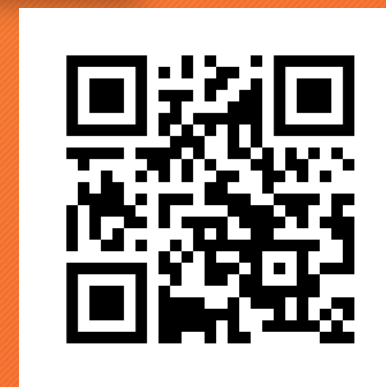
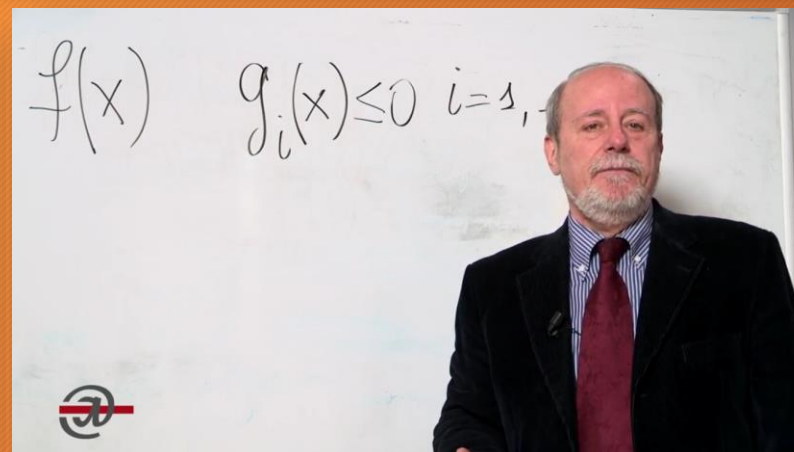
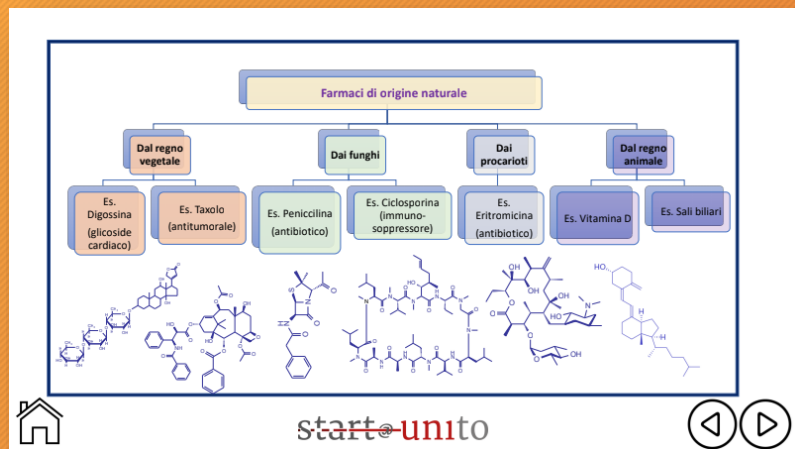
EasyReading

Navigation

- Home
 - Dashboard
 - Site pages
 - Current course
 - Fisica
 - Participants
 - Badges
 - Bussola del corso
 - 1. Metodo scientifico
 - 2. Meccanica
 - 3. Fluidi
 - 4. Termodinamica
 - 5. Elettromagnetismo e Onde
 - 6. Ottica e Fisica moderna
 - Esame
 - My courses

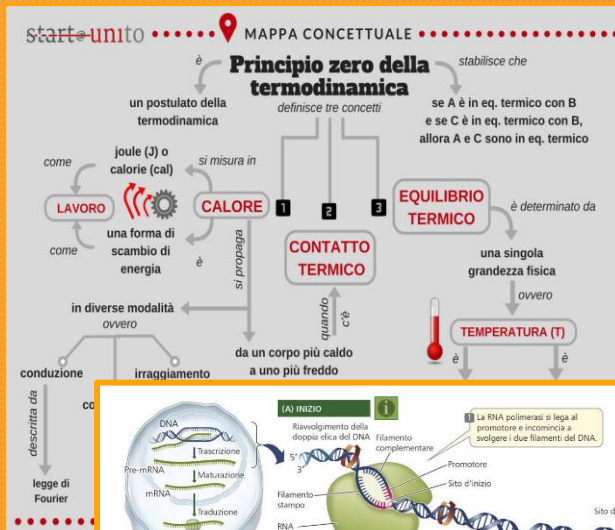


Structure



Interactive materials





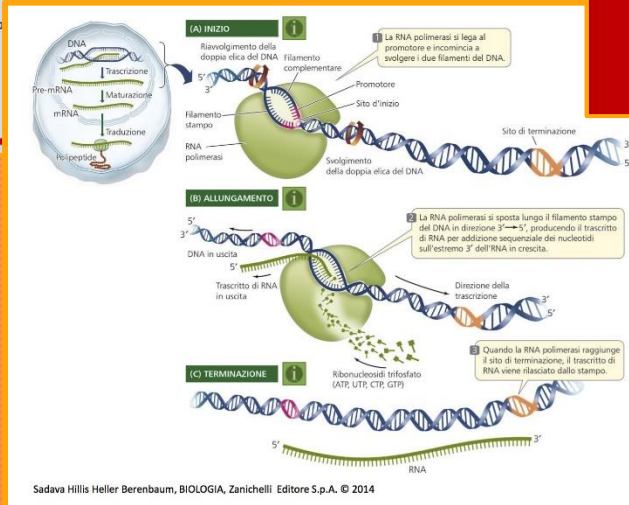
1° LIVELLO i MORFEMI → elementi di prima articolazione: unità minime portatrici di significato

Radice Lessicale: TAVOL - O (Maschile Singolare)

Radice Lessicale: TAVOL - I (Maschile Plurale)

2° LIVELLO i FONEMI → elementi di seconda articolazione: unità minime che non portano significato

Le unità di prima e seconda articolazione **combinano** fra loro e da un insieme possono creare costruzioni potenti



con il quale l'informazione contenuta nel DNA viene copiata in una molecola di mRNA, chiamato messaggero perché trasmette l'informazione genetica dal DNA al dispositivo di traduzione della cellula.

Fai clic sul simbolo vicino alle diverse fasi per saperne di più.

6_Ottica e fisica moderna



Interactive materials

Certificate

This certification is necessary to access the examination

User Sacchet
Codice bOzhglGohG

start@unito

Il sistema informativo Unito conferma l'autodichiarazione di

**Mario
Rossi**

*luogo di nascita Cinisello Balsamo
data di nascita 25 December 1942
codice fiscale RSSMRA42D25XXXX
di avere frequentato e superato con successo i test di
autovalutazione dell'insegnamento universitario*

Start@Unito

*La presente certificazione ammette a sostenere l'esame in
presenza, superato il quale sarà possibile ottenere il
riconoscimento dei relativi CFU.*

Università degli Studi di Torino
3 July 2018



Start@unito OER: secondary school teachers

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Average

The course materials are interesting	4.3
The course materials are reusable	4.2
The course materials are suitable for secondary school students	3.8
The course materials are suitable for teacher self-training	4.2
The course materials are suitable to facilitate the enhancement of excellence	3.9
The course materials are suitable for the student's independent study	3.6
The course materials are suitable for the integration of classroom teaching	3.8
The course materials meet the criteria of accessibility for students with Specific Learning Disorders and / or Special Educational Needs	3.6
The course materials help to understand the practical applications of the discipline	3.8
The course materials are easily navigable	4.2

Training teachers on... Instructional design

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- Teaching how to design materials and how to use the technologies available to **match the educational purposes**, assisting teachers and tutors by providing them with a **set of principles and concept models**
- Instructional design is the sector that operates at the international level to identify the **didactic criteria and models** applicable in the different contexts, in such a way that learning has the highest possible probability to be **effective, efficient, and interesting**

Instructional design

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Median

	Competence	Technical area	Organizational area	Didactic area
Before the training	None	17,24%	6,90%	10,34%
	Low	37,93%	13,79%	24,14%
	Average	31,03%	37,93%	24,14%
	Good	13,79%	34,48%	37,93%
	Very good	0,00%	6,90%	3,45%
After the training	None	0,00%	0,00%	0,00%
	Low	10,34%	13,79%	17,24%
	Average	17,24%	24,14%	17,24%
	Good	41,38%	48,28%	44,83%
	Very good	31,03%	13,79%	20,69%



Training teachers to develop OOCs

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Design of an online course

How to create effective videos

Video-making: screencasts and animations

Automatic Assessment System Möbius Assessment

How to assess: Docimology

Virtual Learning Environment Moodle

Interactive contents

Advanced Computing Environment (ACE)

Rudiments of HTML

Accessibility

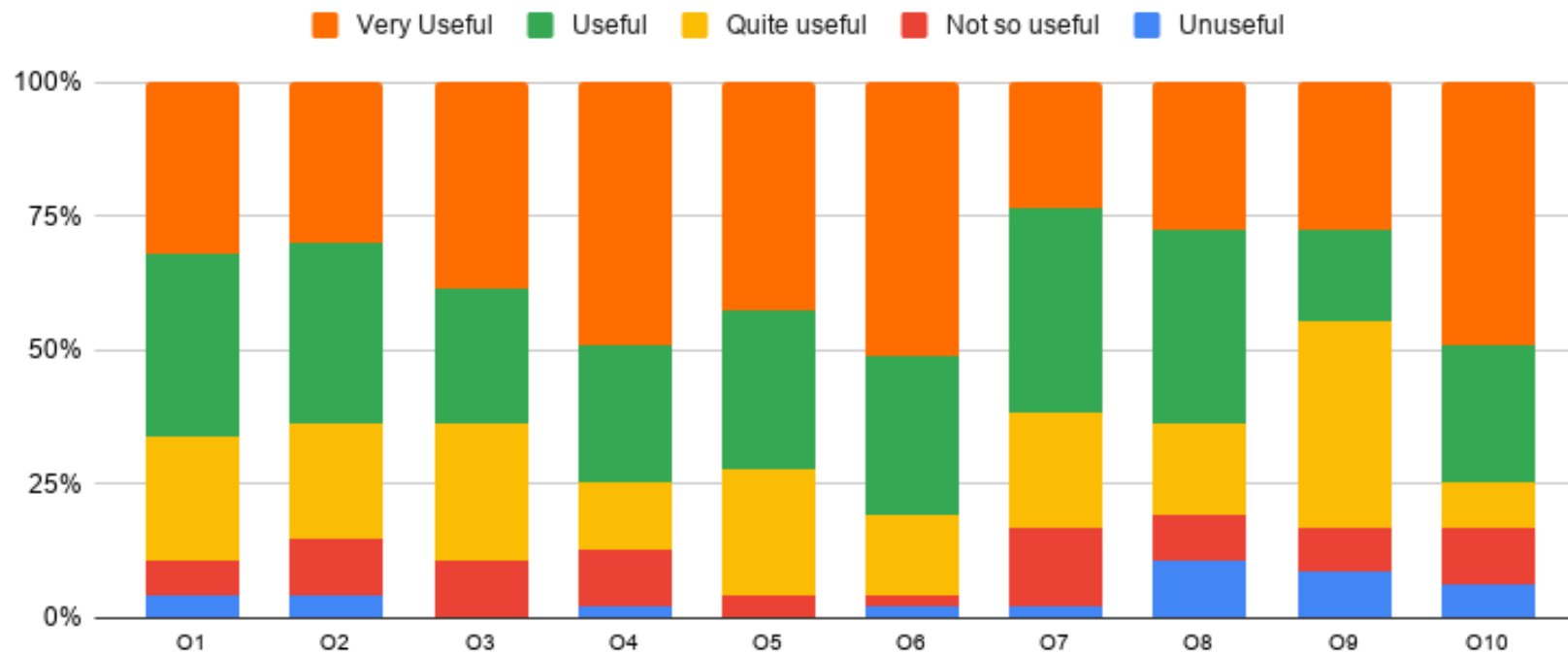
Copyright

Main topics about
online teaching
were presented and
discussed by experts

Start@unito Opportunities

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Likert scores of teacher evaluations

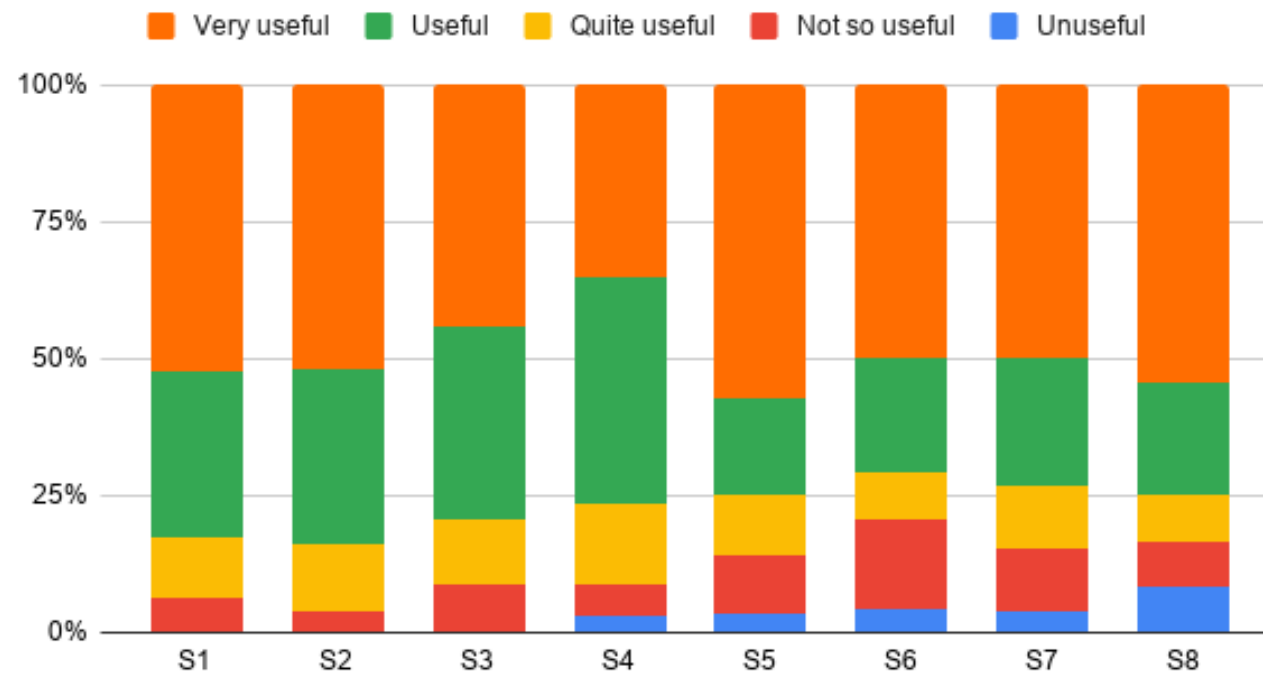


- O1: Expansion of the educational offer
- O2: Anticipation of the students' career
- O3: Support for exams
- O4: Support for students not attending or with special needs
- O5: Reusability
- O6: Availability
- O7: Orientation
- O8: Bridge between university and secondary school
- O9: Support for teachers of secondary schools
- O10: Support for distance learning in the Covid-19 period

Start@unito Support given to teachers

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Likert scores on the support



- S1: Implementation of courses
- S2: Language support (for English-taught modules)
- S3: Course maintenance
- S4: Computerized exam support: opening exams
- S5: Exam assignment assembly
- S6: Exam session assistance
- S7: Exam management of results
- S8: Exam viewing student tests

Comments by teachers - start@unito

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Courses were **precious** during the Covid-19 crisis

The experience of start@unito is **good, very positive**

Positive effect on **orientation**

Useful for those students who had **simultaneous courses** and for those who **could not attend**

The online material was useful for non-attending students, especially those with **difficulties with Italian**

A large number of subscribers
A low number of exams

Comments by students - start@unito

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It is **exciting** to follow, it seems to be in the classroom

Being able to study from home with my **own pace** and being able to understand if I like the university path I will choose

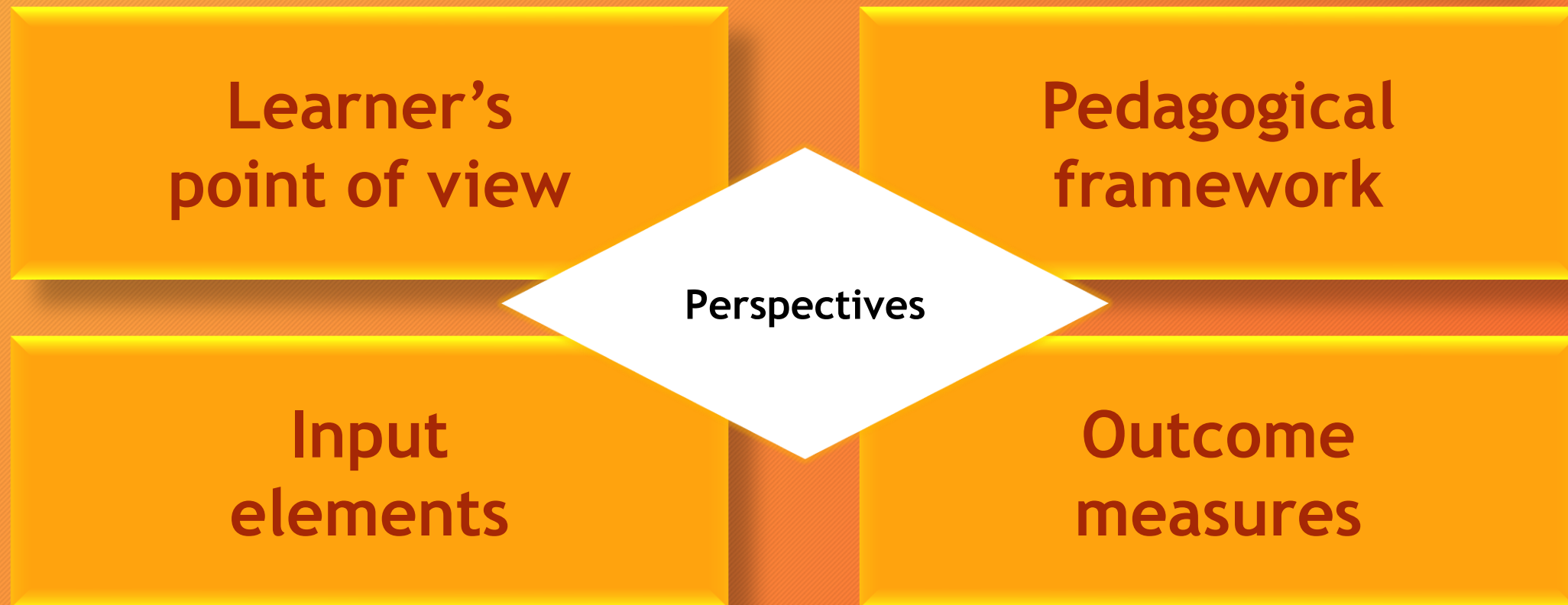
The **simplicity** with which concepts are expressed in general and through videos

Convenience in being able to follow the course from home also means **greater concentration**. Great way to test individual skills

Nice opportunity as it allows you to take an exam at a more intelligent time than scheduled, **ease in finding the content** you need and about which you have more doubts

MOOC quality indicators

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Open Educational Practices

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Use, re-use, create OER promote educational practices through:

- x Collaboration
- x Peer learning
- x Sharing and building knowledge
- x Making students co-producers in their lifelong learning path

OER - Final remarks

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- × OER represent a wealth to be used in Integrated Learning Environments
- × They can be used for activities, as resources for lessons, for insights and in many other ways
- × **Tip:** before starting to prepare a teaching course, look for any useful OER on the web

Learning Analytics

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Stats

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Question	Description	Success rate	p-Value	d-Value	p-Biserial	r-Biserial	Count	Correct	Partial	Incorrect
(1)	 q12sin algo	0,665	0,665	0,447	0,539	0,698	197	131	0	66
(2)	 q11ip02 algo	0,787	0,787	0,426	0,713	1,004	197	155	0	42
(3)	 q11absx05 algo	0,777	0,777	0,387	0,656	0,915	197	153	0	44
(4)	 q12xn01 algo	0,807	0,807	0,34	0,651	0,938	197	159	0	38
(5)	 q12sqrt11 algo	0,858	0,858	0,291	0,69	1,072	197	169	0	28
(6)	 q11ln01 algo	0,822	0,822	0,348	0,758	1,113	197	162	0	35
(7)	 q11exp13 algo	0,746	0,746	0,371	0,604	0,821	197	147	0	50
(8)	 graf-1	0,598	0,492	0,518	0,517	0,648	197	97	49	51
(9)	 q11sig-5	0,655	0,655	0,403	0,551	0,685	197	130	0	67
(10)	 graf-2	0,462	0,462	0,607	0,53	0,61	197	91	53	53

The p-Value of an item is defined as the ratio of the number of fully correct responses to the total number of responses in the data set. A question is deemed to be fully correct only if it has a score of 1.0.

Stats

Question	Description	Success rate	p-Value	d-Value	p-Biserial	r-Biserial	Count	Correct	Partial	Incorrect
(1)	q12sin algo	0,665	0,665	0,447	0,539	0,698	197	131	0	66
(2)	q11ip02 algo	0,787	0,787	0,426	0,713	1,004	197	155	0	42
(3)	q11absx05 algo	0,777	0,777	0,387	0,656	0,915	197	153	0	44
(4)	q12xn01 algo	0,807	0,807	0,34	0,651	0,938	197	159	0	38
(5)	q12sqrt11 algo	0,858	0,858	0,291	0,69	1,072	197	169	0	28
(6)	q11ln01 algo	0,822	0,822	0,348	0,758	1,113	197	162	0	35
(7)	q11exp13 algo	0,746	0,746	0,371	0,604	0,821	197	147	0	50
(8)	q11exp13 algo	0,711	0,711	0,57	0,648	0,648	197	97	49	51
(9)	definitions 5	0,66	0,66	0,458	0,53	0,685	197	130	0	67
(10)	graf 2	0,58	0,462	0,482	0,706	0,516	197	91	53	53

The d-Value measures the discrimination of an item. The dataset is divided into two groups, those in the top-scoring half of the set and those on the bottom-scoring half. The d-Value is the difference of the p-Value for the high-scoring group and for the low-scoring group.

Stats

50

Question	Description	Success rate	p-Value	d-Value	p-Biserial	r-Biserial	Count	Correct	Partial	Incorrect
(1)	q12sin algo	0,665	0,665	0,447	0,539	0,698	197	131	0	66
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(9)	definizione-5	0,66	0,66	0,458	0,53	0,685	197	130	0	67
(10)	graf-2	0,58	0,462	0,482	0,506	0,636	197	91	53	53

The p-Biserial correlation coefficient is an index of discrimination that measures the extent to which students who score high on the assignment tend to get the item correct and those who score low tend to get the item incorrect.

Question	Description	Success rate	p-Value	d-Value	p-Biserial	r-Biserial	Count	Correct	Partial	Incorrect
(1)	q12sin algo	0,665	0,665	0,447	0,539	0,698	197	131	0	66
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(9)	q11exp13 algo	0,512	0,512	0,516	0,517	0,517	197	130	0	67
(10)	q11exp13 algo	0,512	0,512	0,516	0,517	0,517	197	91	53	53

The r-Biserial correlation coefficient is an index of discrimination that measures the extent to which students who score high on the assignment tend to get the item correct and those who score low tend to get the item incorrect.

Formative assessment and Learning Analytics

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	Collect Data	Analysis	Objective	Action
Clarify and share learning objectives and criteria for success	Course module use and grades	Relationship use and grades	Check effectiveness of materials	Improve teaching materials
Architect effective discussions and other learning tasks	Gradebook and stats	Response rate, common errors	Identify unclear points	Create new improved items
Provide feedback that progresses the learner	Gradebook	Variation of answer in ulterior attempts	Check effectiveness of feedback	Improve feedback
Activate students as educational resources for each other	Integrated gradebook	Interactions students and assessments	Assess interactions and learning	Adapt collaborative activities
Activate students as protagonists of their own learning	Questionnaires and logs	Interactive activities and engagement	Evaluate the effect of interactive activities	Improve interactive activities

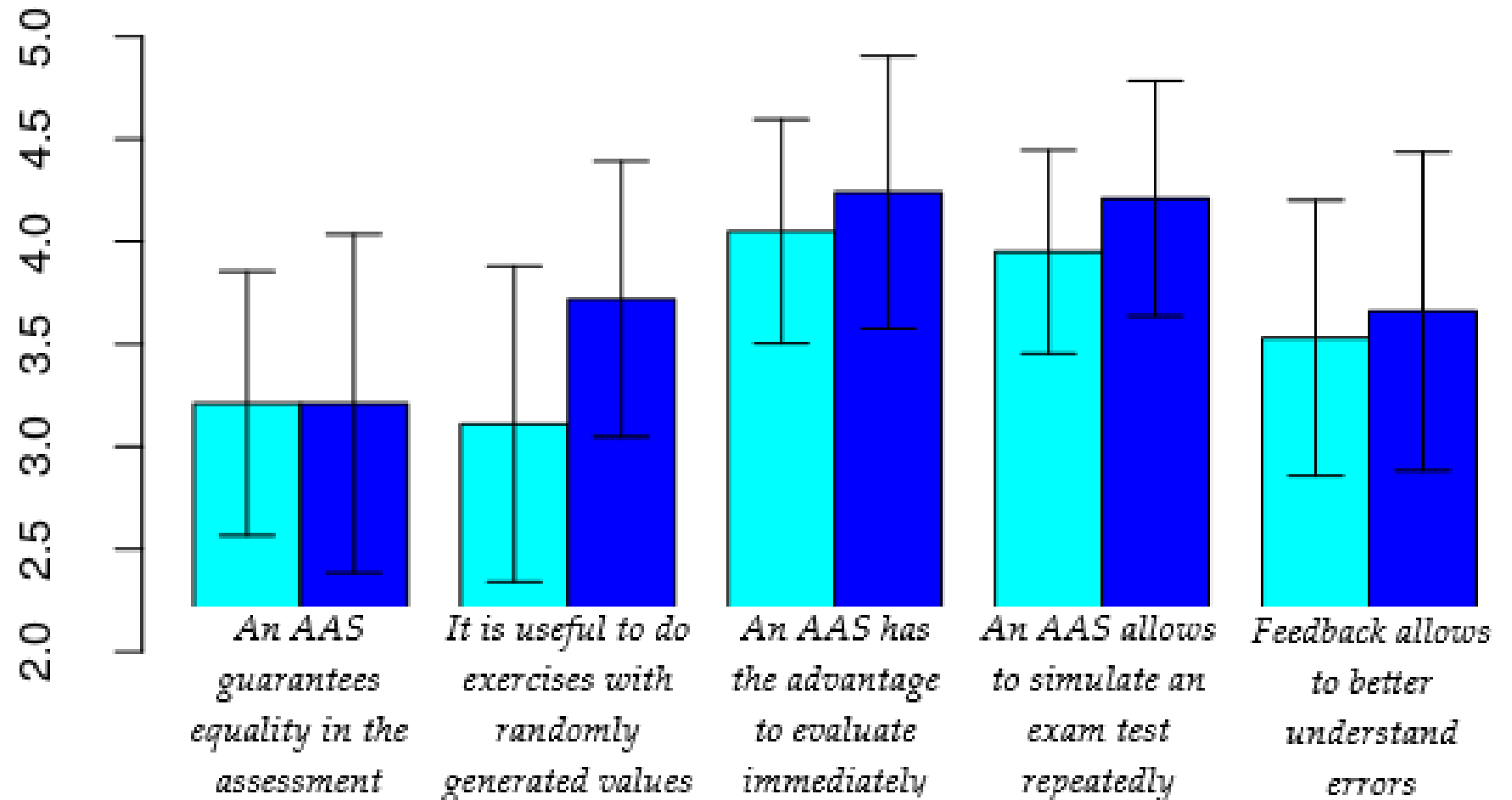
Results

53

Tests inside a course

54

“How much do you agree with the following statements concerning the use of an Automated Assessment System, AAS?”



Results

55

Effectiveness of Automatic Formative Assessment for learning Mathematics in Higher Education

96 Students in
Biotechnology

Course with Automatic
Formative Assessment
activities

Cross-check with the final
exam grades

Students improved their grades by 12.27 points out of 100

22,00
students who never used the online
tests

25,87
students who used the online tests

Scenario

56

First attempt on 11th February 2020 at 5:31 PM

During a summer week, the maximum temperatures recorded at a seaside location over four consecutive days were 31 °C, 34 °C, 33 °C, 30 °C. The temperatures are measured in Celsius degrees.

What maximum temperature should be recorded on the fifth day, for the **mode** of the five readings to be 34 °C? ✓ °C

What maximum temperature should be recorded on the fifth day, for the **median** of the five readings to be 32 °C? ✗ °C

Step by step procedure when wrong: First step

Let's go step by step. According to what is known from the theory, the mode is the **most frequent** ✓ value of the distribution; furthermore, we have values for the first four days 31 °C, 34 °C, 33 °C, 30 °C, all different.

Since the value 34 °C coincides with one of the previous ones, the condition that the mode is 34 °C is equivalent to a maximum temperature of ✓ °C on the fifth day,

so that this data appears exactly ✗ **Correct response: 2** times.

Step by step procedure when wrong: Second step

Since the number of data including the unknown is **odd** ✓ the median is given by **the central value** ✓ 32 °C should be the median with respect to the values

31 °C, 34 °C, 33 °C, 30 °C. Since the value is bigger than ✗ **Correct response: 2** of the other values and smaller than ✗ **Correct response: 2** of the other values,

the maximum temperature of the fifth day will necessarily have to **coincide with** ✓ 32.

Step by step procedure when wrong: Third step

Indeed, if the maximum temperature of the fifth day t_5 is less than 32 °C, than there will be exactly ✗ **Correct response: 3** values between 31 °C, 34 °C, 33 °C, 30 °C, t_5 less than 32 °C,

and this last last value will not be the median. On the other side, if the maximum temperature of the fifth day t_5 is greater than 32 °C, than there will be exactly ✗ **Correct response: 3** °C,

34 °C, 33 °C, 30 °C, t_5 greater than 32 °C, and this last last value will not be the median.

Second attempt on 11th February 2020 at 5:53 PM

During a summer week, the maximum temperatures recorded at a seaside location over four consecutive days were 28 °C, 31 °C, 30 °C, 27 °C. The temperatures are measured in Celsius degrees.

What maximum temperature should be recorded on the fifth day, for the **mode** of the five readings to be 28 °C? ✓

What maximum temperature should be recorded on the fifth day, for the **median** of the five readings to be 29 °C? ✓

Criticism

57

Technical difficulties in entering the right syntax

BUT often students don't read instructions: educative value of "rigidity" of technologies

Students' resistance to the use of technologies

BUT it is important that they learn how to use technologies for educative aims

Students do not attempt any assignment

BUT they are the same that "never do" their homework. Technologies cannot be useful for students who never try to use them.

Good practices

58

Why?

59

Promote student, youth and children's **participation and rights**

Gender discrimination

We cannot return to the world **as it was before**

Make **free and open source technologies** available to teachers and students

The impacts of the virus are **disparate and unjust**

Decisions made today will have **long-term consequences** for the futures of education

Strengthen education as a **common good**

Value the **teaching profession and teacher collaboration**

- Integration of **class activities** with **individual study** experience
- Design of **integrated teaching**
- **Students' engagement**
- **Adaptive teaching**
- **Learning analytics**

Integration of class activities with individual study experience

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Digital assignments and Forum

62

Individual or group activities

At home or in the classroom

Activate and evaluate skills

Peer evaluation

Initiate or carry on discussions

Asynchronous mode

Collaboration between distant students

Evaluation of interventions

Design of integrated teaching

63

Design of formative activities

64

- Topic
- Types of activities and useful resources (OER)
- Technologies
- Time definition
- Activities to support different learning styles
- Descriptions, indications, and monitoring

Example: design of a lesson

65

For each phase:

- Kind of activity
- Methodology
- Resources and activities
- Estimated time
- Short description
- Any digital tools in support

Phase 1: introduction to the topic of the lesson (15 min.)

- Short survey (with PC, smartphone, etc ...) with tools such as mentimeter and discussion / introduction to the topic

Phase 2: theoretical explanation (30 min.)

- Possibly supported by technology (slides or other shared material, interactive files, graphic tablet, etc.)

Break (15 min.)

Phase 3: group work (20 min.)

- Students divided into groups try to solve a problem related to the topic presented
- Distance needed or online lesson? Support technology (chat, forum for groups, interactive virtual classroom, etc ...)
- No distancing? Groups in the classroom and delivery of work on the platform

Phase 4: discussion of group work (15 min.)

- Teacher and students comment and discuss the resolution of the problem (s)

Phase 5: test to consolidate what has been learned on the subject (10 min.)

- Individual activity (synchronous) with an automatic evaluation system

Phase 6: Assigned Asynchronous Tasks (5 min.)

- Presentation of the activities and resources made available on the platform for study and further study

Importance of design

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Effectiveness of the activity increases

Constant monitoring of progress

Facilitates adaptive teaching and learning

Respond to unexpected situations

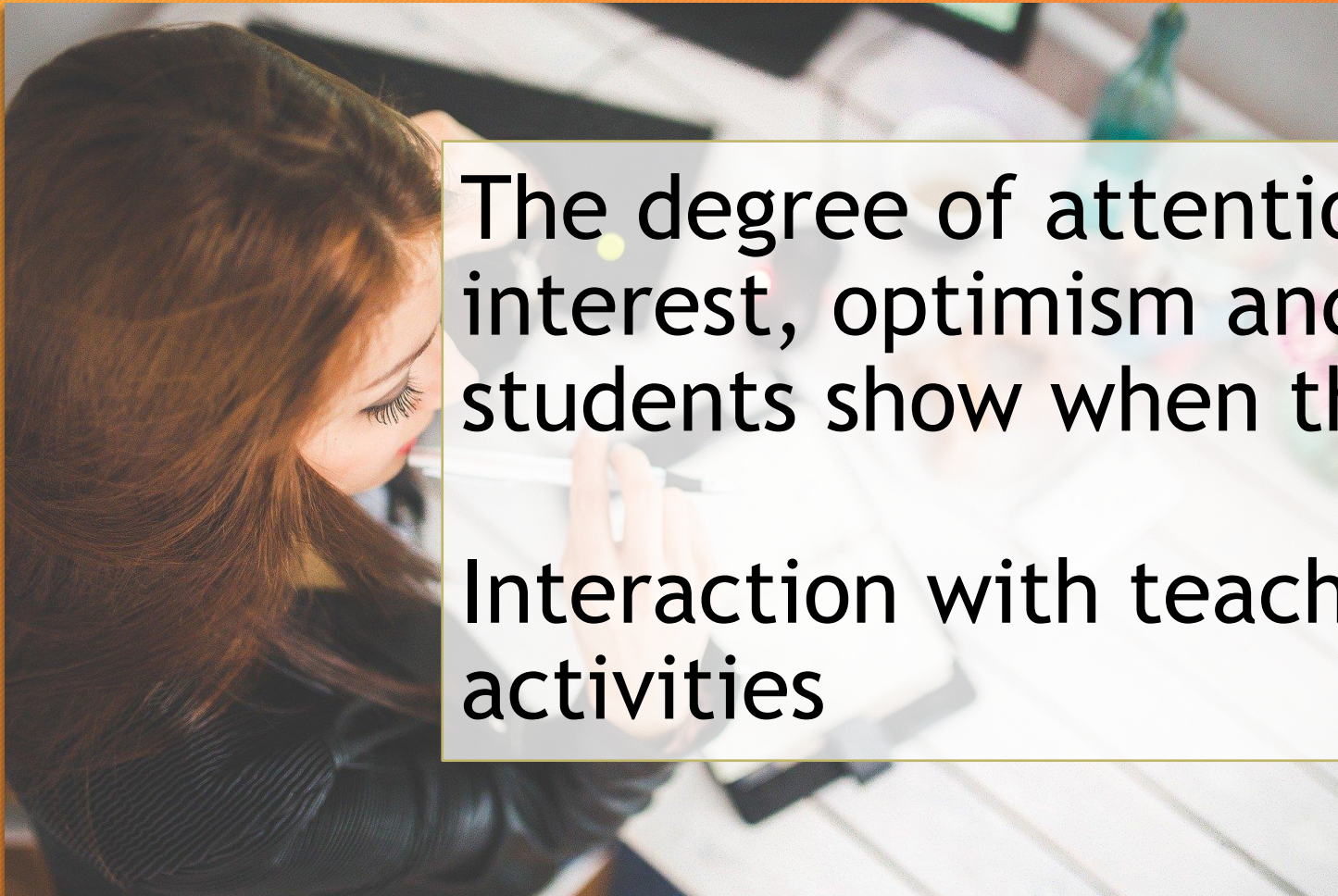
Integrate presence and distance

Students' engagement

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Engagement

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The degree of attention, curiosity, interest, optimism and passion that students show when they learn, they learn

Interaction with teachers, classmates, activities

Engagement → Achievement

69



- **Cognitive Engagement:** desire to learn, motivation
- **Behavioral Engagement:** active participation
- **Cultural Engagement:** integrate different backgrounds
- **Emotional Engagement:** positive feelings in students
- **Physical Engagement:** practical activities, realize, create
- **Personal Engagement:** single aptitudes
- **Social Engagement:** sense of school community

Different strategies

70

- Connecting learning to the real world
- Discover the interests of the students / them
- Fill in the dead times
- Use teamwork and peer collaboration
- Encourage to present and share
- Giving a voice to students / them
- Make students move
- Clarify the objectives and goals
- Give feedback
- Emphasize discovery and investigation
- Ask questions for discussion
- Give yourself time to think
- Introduce elements of gamification, self-monitoring
- ... and much more!



List objectives and goals

Students monitor their learning

Le funzioni elementari

Contenuto	<ol style="list-style-type: none">1. Definizione di funzione2. Funzioni elementari: lineare, quadratica, valore assoluto, funzioni circolari e loro periodicità, esponenziale e logaritmica3. Esempi di funzioni e loro applicazioni
Obiettivi	<ol style="list-style-type: none">1. Saper riconoscere e tracciare il grafico delle funzioni elementari.2. Saper comunicare usando in modo appropriato la terminologia specifica.
Tempo di completamento	300 minuti

Il tuo stato di avanzamento ?

Sondaggio iniziale con mentimeter codice XXXX

Opinion of students

Problem solving

72

Real-world context



Problemi sulle funzioni

Problemi da risolvere in gruppo sulle funzioni.

Per confrontarsi si può utilizzare la chat creata apposta per il gruppo di lavoro

Tempo di risoluzione: 20 min

Condizioni per l'accesso: Appartenere a qualsiasi gruppo



Chat Gruppo1

Condizioni per l'accesso: Appartenere al gruppo Gruppo1



Chat Gruppo2

Condizioni per l'accesso: Appartenere al gruppo Gruppo2



Proposta di soluzione

Condizioni per l'accesso: L'attività Problemi sulle funzioni deve risultare spuntata come completata

Tempo stimato: 10 min.

La coltura di batteri

Una coltura di batteri possiede inizialmente 50 individui. Maggiore è il numero di batteri, maggiore sarà il tasso di crescita, per cui supponiamo che il tasso di crescita di tale popolazione sia direttamente proporzionale alla popolazione stessa secondo una determinata costante. Vogliamo utilizzare questo dato per calcolare quanti batteri saranno presenti dopo un certo periodo di tempo. Assumeremo anche sempre di poter trattare il numero di batteri come una quantità continua.

1. Perché questo modello, benché semplice, non consente una previsione realistica?
2. Perfezioniamo il modello introducendo il concetto di capacità portante, ovvero considerando una quantità massima di batteri che il sistema può supportare. Se la popolazione ammissibile è di 1000 individui, possiamo dire che il tasso di crescita della stessa $y(t)$ è proporzionale al prodotto tra $y(t)$ e $1000 - y(t)$, dove con $y(t)$ viene indicata la quantità di batteri al tempo t espresso in giorni. Cosa si può dire qualitativamente su come varia il tasso di crescita e sull'andamento della popolazione al passare del tempo?
3. Si determini quantitativamente quanto discusso nel punto precedente, impostando l'equazione differenziale che descrive la crescita della popolazione batterica, e risolvendola. Commentare il risultato anche in relazione alle osservazioni qualitative. Si supponga che il tasso di crescita sia $\alpha = 0.001$.

Emphasize discover and research

Group work
Collaboration

Adaptive teaching

73


Adaptive activities



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Individual or group activities of a homogeneous level

Adaptive activities to guide students with more difficulty

Additional or in-depth activities for those who finish basic activities




 Determinare l'equazione della retta tangente alla curva di equazione $y = -2x^3 - 3x$ nel punto P di ascissa $x_P = -1$.

$y =$  






Una retta tangente ad una curva in un suo punto avrà come **coefficiente angolare** il valore della **derivata prima della funzione calcolata nel punto**.

Determiniamo la derivata prima della funzione:

$y' =$   

e calcoliamo il coefficiente angolare sostituendo alla x il valore -1 :

$m = y'(-1) =$   






Trovato il valore del coefficiente angolare, dobbiamo determinare l'equazione della retta.

La retta apparterrà al fascio di rette passanti per il punto P e avrà equazione del tipo:




$$y - y_P = m \cdot (x - x_P)$$

Conosciamo x_P , che ci è fornito dal testo, conosciamo m , che abbiamo appena calcolato, dobbiamo determinare y_P .

y_P è l'ordinata del punto P e può essere calcolata sostituendo il valore $x_P = -1$ nell'equazione della funzione

$y_P =$   

Sostituendo i valori trovati nella formula del fascio di rette, otteniamo l'equazione della retta tangente nel punto P:

$y =$   


Automatic Formative Assessment

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- Adaptive questions
- Immediate feedback
- Interactive feedback



At home: guide in case of difficulty



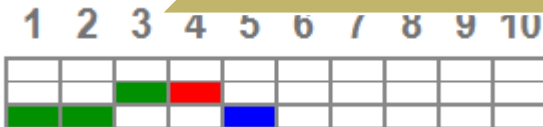
In the classroom:
everyone can proceed
according to their
level of competence

Adaptive Assignments

76

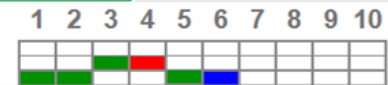
Proceed according to
your learning level

Understand your
learning level



Calcolare l'integrale indefinito

$$\int 3\sqrt{1-x^2} + \frac{4}{x} - \frac{5}{1+x^2} dx$$



Il Teorema Fondamentale del Calcolo Integrabile afferma che se $f : [a, b] \rightarrow \mathbb{R}$ è una funzione su $[a, b]$ allora la funzione F definita da

$$F(x) = \int_a^x f(t)dt, \quad \forall x \in [a, b],$$

è su $[a, b]$ e vale la relazione:

- $F'(x) = f(x)$, per ogni $x \in [a, b]$
- $f(x) - f(a) = F'(x)(x - a)$, per ogni $x \in [a, b]$
- $F(x) = f'(x)$, per ogni $x \in [a, b]$
- $F(x) - F(a) = f(x)(x - a)$, per ogni $x \in [a, b]$

Hints for group activities

77

- ✓ Create homogeneous groups, same level of competences
- ✓ Use adaptive questions so that troubled groups can be guided by the system
- ✓ Leave additional tasks for those who finish basic tasks
- ✓ Propose problems open to various solution approaches
- ✓ Hand out colored cards that each group can show

All right

Come when
you can

Urgent need
for help

Thank you for your attention!

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With the patronage of



Activity

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- Explore start@unito at <https://start.unito.it>